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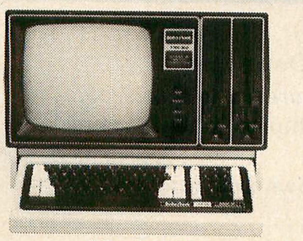

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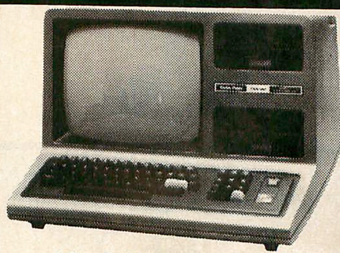

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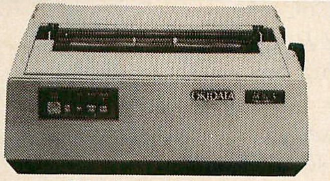

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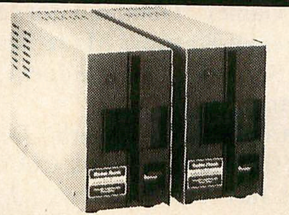

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Under the Rainbow

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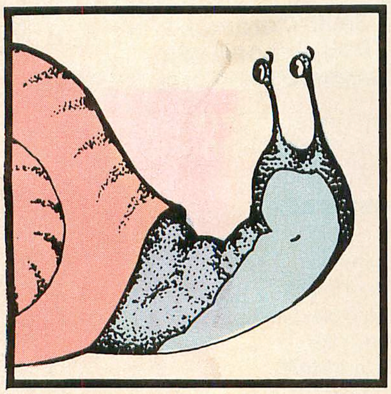

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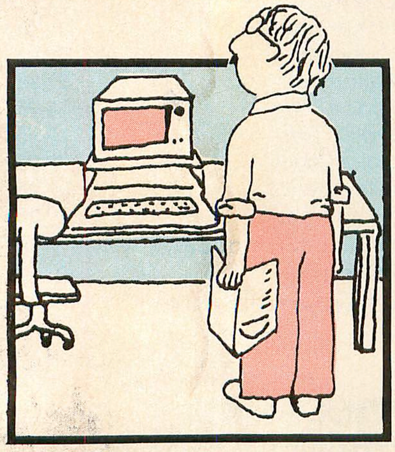

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Due to family illness, Dennis Lewandowski's Assembly Corner does not appear this month. It will return in August.

THE PIPELINE CONTAINS AN EXCLUSIVE FIRST PREVIEW OF THE NEW TRS-80 MC-10 MICRO COLOR COMPUTER

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NEXT MONTH: Football season starts soon, and the August *Rainbow* will be in the thick of it, with a football game. You can start training early. Also, an excellent new column for educators to go with our fine new LOGO offering.

The memory map will be back — for Part II. It is really a big one and will be with us for a couple more months, yet. And, perhaps, a *very special* report.

Plus . . . some more music, more games and just more of everything — programs, reviews, and information on CoCo than you can possibly find *anywhere* else. Don't miss August's *Rainbow*!

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letters to RAINBOW

PAINT 15L: NEW

Editor:

I would like to share with your readers a discovery I have made.

I use and move my computer quite a bit. Hence, there are several places on it where the paint has worn off. A local Radio Shack dealer told me to try an automotive touch up paint.

I found that General Motors makes a color called "Silver Sand," code 15L. It is a perfect match. A company named Dupli-Color markets it in spray cans. Dupli-Color's code is DS-GM 326. Now my CoCo looks new again!

Frank Cerra
Kansas City, MO

RAY LIKES HIS 'K'

Editor:

I received a CoCo for Christmas and got your magazine in January. Your monthly editions have helped me a great deal in understanding different areas of the machine, but what I really want to know is how to gain full usefulness of the memory in my machine.

I have the new version of the CoCo with the 'F' board. What I want to know is why can't I access the full 64K of my chips, and would it be possible to piggyback a set of 64K chips to expand my memory to 64K Extended plus 128 with a DOS. Please help.

Raymond Wise
Stuart, FL

Editor's Note: The 6809 Processor has 16 address lines and therefore can address 64K bytes. You have to have an operating system to tell the processor what to do, such as BASIC. This operating system occupies memory. Therefore the maximum memory accessible is = (64K — operating system). In the case of Extended BASIC this leaves you 32K of user memory as the BASIC ROMs occupy the top 32K.

64K may be better utilized by some of the more sophisticated disk systems and software such as FLEX but at no time can you access more than 64K.

BENJAMIN'S BORDER

Editor:

I enjoyed the article by Ray Gauvreau to put a border around the CoCo screen. I have a 16K standard Color BASIC and was disappointed to read that Ray's program required ECB.

However, with the help of the instruction manual, I made the following changes and ran the program successfully.

```
30 POKE 275,63: POKE 276,224
110 IF BN>32767 THEN 100
120 CLS (RND(8)):X=USR(BN)
140 X=USR(BN)
160 X=USR(BN-3)
```

I had to save the entire program since Color BASIC will not save machine language. Also, if you *BREAK* after the first *RUN*, you need to enter RUN 100. Entering *RUN* will get a SN error.

I spent several hours playing with this program and trying different combinations.

I would like to see more articles for Color BASIC. I do enjoy your magazine.

Benjamin W. Brunotte
Beaumont, TX

LET ME COUNT THE WAYS

Editor:

I thought the review of *Gazon* in your April issue was fair, but there are two things I would like to clear up. First, the game does not require Extended BASIC. Second, you can fire in 32 directions, not eight.

David A. Sweet
(Author of Gazon)
Carmel, IN

DISCOVERED BY OCCIDENT

Editor:

With regard to the letter from Mr. R.W. Odlin in your April issue in which he describes the apparently accidental discovery of Japanese characters while using his CGP 115 with the *Telewriter 64* direct printer control command: He must have had DIP switch 4 set to the special characters position and then entered the Hex values for the Japanese Kana character set directly to the printer buffer via the Direct control code command.

The Japanese Kana character set will be selected in the codes A0(Hex) through DF(Hex). This character set is also implemented in the Radio Shack LPVIII if DIP switch 8 is set to the closed position.

I would like to congratulate you on the truly excellent quality of your magazine. It is marketed locally through Atlantic News, which carries the best selection of computer publications to be found in Canada. I would also like to compliment Ms. Sally Nichols and Mr. Jerry McKiernan on the outstanding job they have done in producing your new format. It's absolutely super.

Wishing you every success with your fine publication.

Andrew Gorman
Halifax, N.S. Canada

RAINBOWFEST

Editor:

I am not one to write letters to magazines, but I felt compelled to write this one. I want to thank *Rainbow* magazine for the wonderful time I had at RAINBOWfest. I didn't set up a booth for the show as I didn't really expect that many people to trek to Chicago for a computer show. Boy, was I wrong! If anything would be living proof of the solidarity of the CoCo, it was what took place April 22-24 in the Hyatt-Regency Woodfield in Schammburg. It was great to see the aisles packed with fellow CoCo users and a real pleasure to meet my fellow CoCo advertisers. Though RAINBOWfest would have been very profitable for my company, that would rate a poor second to the experience that I will remember from it. I want to thank you again and am anxiously awaiting RAINBOWfest II. And you can bet that I will have a booth at that one!

Bob Rosen
President, Spectrum Projects
Woodhaven, NY

Editor:

Congratulations, kudos and a thousand thank yous for RAINBOWfest. A success and a pleasure for all involved.

John and Linda Nielsen
Moreton Bay Software
Santa Barbara, CA

Editor:

Just wanted to drop you a short note thanking you for sponsoring the RAINBOWfest. My wife and I learned much . . . and had an excellent time doing it.

We will certainly look forward to the next one!

Again . . . thank you!

Len Baas
Traverse City, MI

Editor:

It was really a pleasure meeting you and some of the other staff members at RAINBOWfest. Everyone I spoke with thoroughly enjoyed it. It's hard to imagine how many people will show up for next year's once they find out how much fun they missed.

Gerry Schechter
Yonkers, NY

Editor:

Thank you and all of the participants at RAINBOWfest who made the show such a success. The vendors who were there were all very pleasant and most helpful. I am writing to express my special thanks publicly to Paul and Susan Petrocci of Petrocci Freelance. Their kindness and consideration to me personally far exceeded that which could be expected of them to extend to a total stranger. I look forward to seeing them again, together with all of *the Rainbow* people at next year's show—wherever *the Rainbow* touches down again.

Thomas P. Daly
Waukegan, IL

LLIST RONG

Editor:

Your reviews of our products Electricity Consumption Moniter and *LLIST-Rite* were more than we expected. In both cases, the reviewers had done their homework programmatically as well as operationally, with the result of providing prospective purchasers very accurate information on which to base their buy decision. Well done, and thanks to your reviewers for a few compliments along the way.

I *would* like to point out that the sample output from the *LLIST-Rite* utility on page 204 is not correct. It does represent how *LLIST-Rite* separates complex program statements, but shows each line break with a new line number and '(comment). Apparently, either the author or your staff used the ROM *LLIST* function to simulate how *LLIST-Rite* works, but forgot to remove the line numbers and '.

Finally, add my name to the growing list of folks in this business who view *the Rainbow* as not just the best Color Computer magazine, but the best computer information source of its kind!

Tom Mardis
Owner, CoCoDATA Enterprises
Orlando, FL

NO TIRARING PIEDRAS, PLEASE

Editor:

The *Spanish One* software reviewer in April *Rainbow* gets an "F" in Spanish.

In Spanish, they *do* use "yo," a nominative pronoun as an object of a preposition, e.g., "entre usted y yo."

The reviewer translates "Buenos Dias" as "Hello." Maybe so, but in actual use it is used only in the morning before noon. Does she think we only read *Rainbow* in the morning? You might say "Good Morning" in a morning newspaper, but not in a monthly magazine.

"Programa" doesn't end in an "e." It's an exception to the rules. It's a masculine noun from Greek, not Latin, and ends in an "a."

The reviewer should learn this sentence: "Los que viven en casas de vidrio, no deben tirar piedras."

Literal translation: "Those who live in houses of glass, should not throw rocks."

Conrad Kirksey
Houston, TX

HINTS 'N' TIPS

Editor:

In the April issue, a letter from Max Shank indicated that he was unable to run the *UNIDATFL* program (June, 1982 issue) in the upper 64K section using my program (January, 1983 issue) for relocating BASIC programs to the upper 64K section of RAM, thus allowing for more data to be stored for the program.

In order for *UNIDATFL* to work in the upper 64K section of RAM, you have to delete step 1 which has a "GOTO 4000" statement. Steps 4000 and 4010 contain a subroutine for relocating *UNIDATFL* starting at &H0E18 and since you want the program to remain in the upper section of RAM, this subroutine must be avoided by deleting step 1 of the program.

The above correction will allow you to increase the number of records to be stored. Therefore, line 60 of *UNIDATFL* could be changed to read: "CLEAR 25000: D=500: DIM N$(D)."

Jorge Mir
New Berlin, WI

Editor:

I want to thank Roger Schrag for his two patches to *EDTASM+*. That in itself more than paid for my subscription to *the Rainbow*.

I would like to offer a short patch to his that will print the disk directory when a L or W command is entered. I found myself forgetting the files I had on the disk and this seems to have solved the problem.

Insert these lines after line 100 (FNAME PSHS U) of the original program.

```
PSHS DP,X,Y
CLRA
STA  >$006F  RESET SCREEN-PRINTER SWITCH
TFR  A,DP    CLEAR DP REGISTER
JSR  $CBCF   DIR ROM ROUTINE
PULS DP,X,Y
```

Reassemble the program following the instructions in Roger Schrag's article.

Craig Levang
Anoka, MN

CHAIRMAN OF 'D' BOARD

Editor:

As author of the March article "64K Modification For 'D' Board," I have been overwhelmed with the response from your readers. Many express thanks for the modification described. Unfortunately, a few people have had problems getting the conversion to work. I've attempted to answer all questions as rapidly as possible (usually within one day). Some difficulties are to be expected with any article on hardware modifications.

Difficulties experienced fall into three general categories:

1) Using the described D-Board modification or 'E' or even 'F' series CoCo boards. The modification can work on these boards although not exactly as described.
2) Not making all the changes indicated. It simply won't work if all the wires are not connected or if the jumper blocks haven't been reconfigured.
3) Simply not understanding the article because of no familiarity with the CoCo or electronics wiring. I think it's great that some of you tried, even without this knowledge. That's how progress is made. I'll certainly do what I can to help you out.

If you're having difficulty, by all means, write me at 113 Boone Road, 15085. Describe the problem as completely as you can. Include a sketch of the modifications you installed. Include a checklist showing that all steps described in the article were completed. Include a self addressed stamped envelope. If you are in a hurry, call me at (412) 373-3363 after 6 p.m. EST. Have your CoCo open in front of you when you call.

Brian H. Alsop
Trafford, PA

ABUNCHA BBS'S

Editor:

Dr. D's CoCo Corner is a new Bulletin Board Service for the Color Computer. I would very much appreciate it if you would publish my BBS number in your magazine, as I do subscribe, and recommend it to all my BBS users. This BBS runs 24 hours a day; we support upload and download. My BBS phone number is (904) 456-7195.

Gary Dunsford, Sysop
Pensacola, FL

Editor:

Tom Mix Software is pleased to announce that we are now running a 24 hour bulletin board. The board is a total dedication to the Color Computer and will carry programs for downloading for the Color Computer.

We, like most boards, are looking for good public domain programs that will be uploaded to the system.

Our 24 hour BBS number is (616) 364-8217.

Tom Mix Software
Grand Rapids, MI

Editor:

I have set up a CoCo BBS in Morgantown, W.Va., called the Mountaineer Softline. It is open 24 hours a day, seven days a week. The phone number is (304) 599-0760. I would also like to compliment you on your fine magazine and I love how you have grown.

Wallace Colyer
Morgantown, WV

Editor:

I would like to use your excellent publication to inform everyone of a new Bulletin Board Service in Arlington, Mass. I am running the Color-80 (Silicon Rainbow products) BBS system on my 64K Color Computer. It is up 24 hours a day at 300 baud. The number is (617) 646-6809.

Also associated with this, I have formed a Color Computer user's group for the Boston area. Those wishing details can log onto the BBS or write to me directly at 3 Acton Street, 02174.

Greg Moore
Arlington, MA

KUDOS

Editor:

Has it really been two years? Who would believe that the little four page photocopy would turn into the finest magazine available for *any* computer. Just when I think I have finally gotten nearly all the way through an issue, the next one arrives, even better than the last!

Keep up the great work. I am proud to have played some small part in your fine efforts.

Fred B. Scerbo, President
Illustrated Memory Banks
Williamstown, MA

Editor:

I want to congratulate you on your new look. *Rainbow* is already a good magazine, but now it is also a very professional looking magazine. It seems right at home on the newsstand.

Jack Gurner
Memphis, TN

ORG! THAT'S CONFUSING

Editor:

I have been experiencing difficulties with Radio Shack's *EDTASM+* cartridge. When certain assembly language programs are entered into the editor, it seems to get the labels confused. On assembling the program, the editor returns a "Multiply Defined Symbol" error as it reaches every label. I have run into this problem several times, but only on three programs. Otherwise, *EDTASM+* works perfectly.

Alan A. Farmer
Charlottesville, VA

Editor's Note: The problem you are having is due to a double symbol table being accessed due to the location of your in-memory assembly. Try a different *ORG* statement.

CLUBS, CLUBS, CLUBS

Editor:

Those interested in activities of the Alaska Color Computer User's Group should write me at 816 N. Pine, #2, Anchorage, Alaska, 99504 or call (907) 274-5778.

Rick McDannel
Anchorage, AK

Editor:

I am interested in forming a Color Computer user's group in the Iowa City area. Interested people may contact me at R. R. #6, The Woods, Iowa City, Iowa, 52240.

I think you have a very fine and necessary publication, keep it running.

S.P. Chapler
Iowa City, IA

Editor:

I have received *the Rainbow* for several months now and each month just gets better and better. I am impressed with the quality and professionalism of your articles. In addition, on the one occasion when I had a problem that I couldn't solve and called for help, your staff was both courteous and successful in helping me contact the person I needed to talk to. Your magazine is read from cover to cover each and every month both by myself and by my students at the school where I teach.

I would like to announce the formation of our user's group here in our area. We are called the Mil-O-Bar Color Computer Club. We anticipate a turnout of around 35 at our next meeting. We meet on the last Thursday of each month at Ona Junior High School We welcome any and all who are interested. In addition, we would like to exchange ideas with other clubs on by-laws, newsletters, etc. Call me at (304) 743-4752 or Barry Huffstutler at 743-5356. Please call on Wednesday, Thursday or Friday.

Jim Lemaster
Milton, WV

Editor:

We are calling our user's group Ogden CoCo and *Rainbow* readers are welcome to exchange newsletters or otherwise contact us by writing to 4535 S. 2600 W., 84067.

Kathy Rush
Roy, UT

Editor:

The Color Computer Club of Sarasota meets the last Thursday of every month at 7:30 p.m. at 4047 Bee Ridge Road, Sarasota, Fla., 33582.

Interested CoCo and TDP-100 users are welcome to attend or to contact me at (813) 921-7510.

Ernie Bontrager
Sarasota, FL

Editor:

I am pleased to announce the organization of a Color Computer Club in the greater Birmingham area. Anyone interested should write me at P.O. Box 335, Gardendale, Ala., 35071, or call (205) 631-3320 or 798-2355.

I would also like to compliment you on the continuing excellence of your magazine.

Joseph Bell, Jr.
Gardendale, AL

Editor:

I recently purchased a Signalman modem for my CoCo. I also purchased the Colorcom/E software cartridge to accompany the modem. My only problem is that the modem has a DB-25 male connector and my CoCo has a 4 pin serial I/O socket. The man I bought the modem from said, "You have to buy an adapter to use it on your computer." So I called everywhere I could think of and everybody said that they never heard of that kind of adapter. Can anybody help me find one?

I also would like to try to start a CoCo user's club in the Linden/Rahway area. Anyone interested please contact me at 73 B Wavecrest Avenue, 07036, or call (201) 925-1827.

Bud Lavin
Winfield, NJ

Editor:

We are pleased to announce the Metropolitan Greenville Color Computer Club formed in January of this year and already almost 50 members strong.

The MGCCC serves the interests of present and prospective CoCo owners in the entire western South Carolina region. As a group, we are totally committed to computer literacy among ourselves and within the community. Members enjoy a lively exchange of computing information, free language, programming and hardware tutorials as well as a biweekly club newsletter.

Meetings are held every Tuesday at 7:30 p.m. in the Plain Elementary School, Simpsonville, S.C.

Anyone wanting more information about this dynamic organization may contact me at any time at (803) 876-3928 or -3812, or write.

Ed Lowe
Gray Court, SC

Editor:

Any CoCo owners in the Bloomington-Normal, Ill., area, interested in starting a user's group, SIG, etc., please contact me at 184 Southgate Estates, Bloomington, Ill., or phone (309) 828-4671.

Ray Myers
Bloomington, IL

Editor:

I would like to announce the formation of a TRS-80 Computer Club in southwest Oklahoma. As of this writing, we have 32 members. Anyone needing additional information can call me at (405) 355-7254, or the Secretary of the group, Cebe Mayse, at (405) 536-1907. We are currently calling ourselves S.L.U.G. (Southern Lawton Users Group).

Dan Goddard
Geronimo, OK

Editor:

Those in the Louisville and southern Indiana area who would like to get a Color Computer Club started should contact me at 2603 Garden Lake Lane, 40220, or call (502) 491-1853.

Roger Idstrom
Louisville, KY

Editor's Note: Roger, read on.

Editor:

We are forming a Color Computer group in the Louisville area, and would like very much to hear from anyone interested in joining us. For more information, contact me at 2820 Del Rio Place #27, 40220.

Stephen Hess
Louisville, KY

Editor:

I am interested in forming a CoCo Club in the Kannapolis/Concord/Salisbury area in North Carolina. All CoCo owners interested please contact me at 2419 Lane St., 28081 or call (704) 932-6653.

Mike Mundy
Kannapolis, NC

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The series, "BEING BOSS",offers to the user the latest in management skill development concepts and should prove to be an invaluable TOOL for anyone who wishes to reach their full potential as a leader. The author has condensed week long intensive workshop material into this outstanding package. The accompanying user's manual is very well written and is easily understood by anyone.

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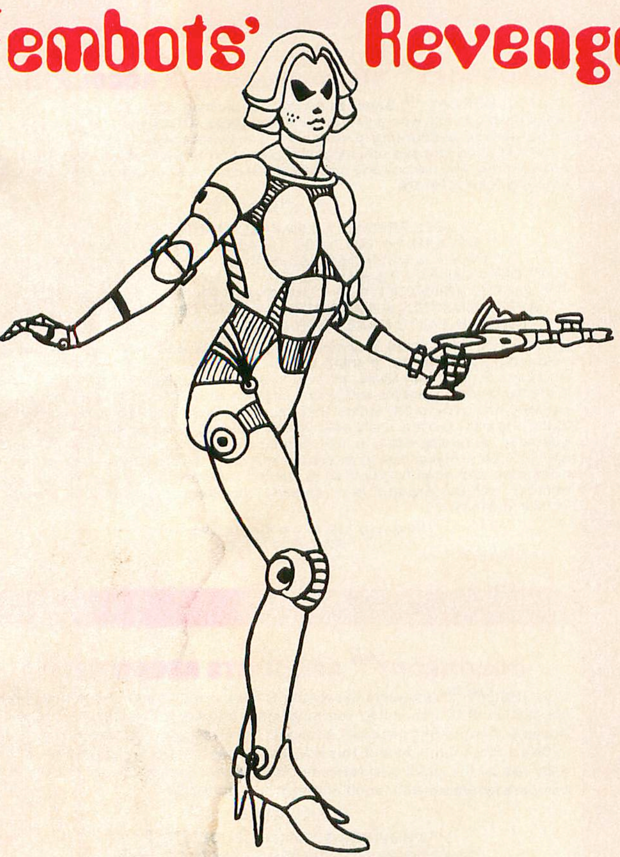

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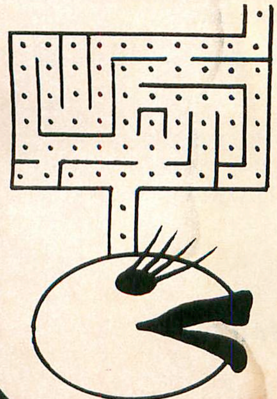

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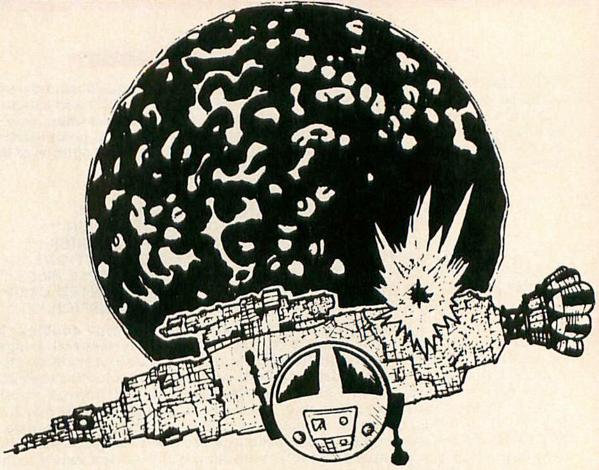

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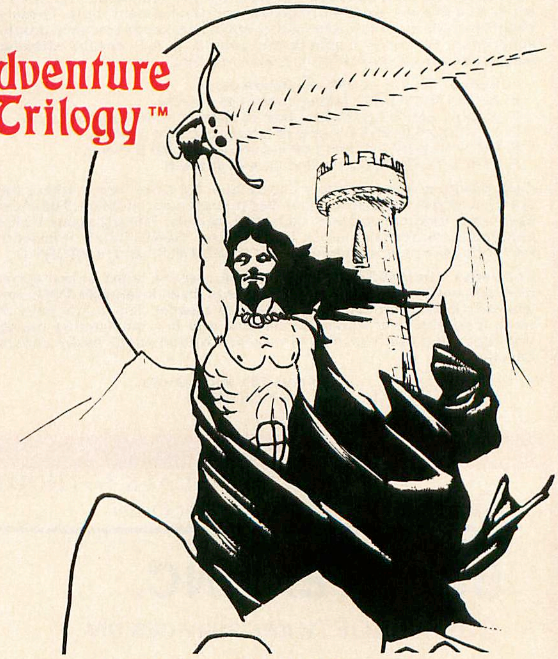

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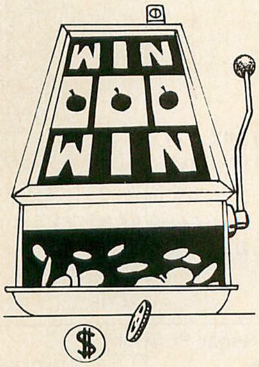

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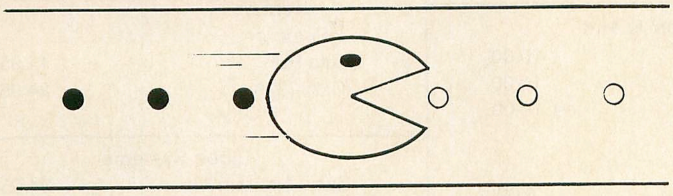

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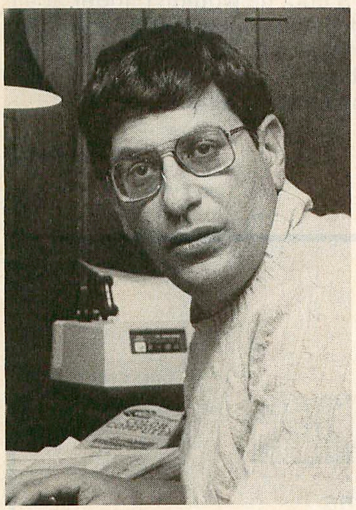
Print #-2,

What a fitting way to lead into the beginning of *the Rainbow's* third year and this Second Anniversary Issue!

What I am speaking about, of course, is RAINBOWfest, which we held in Chicago in late April and on which you will see a report—in both words and pictures—in this issue. To quote one of the people who attended, it was a "smashing success." The booths were full, the aisles were even fuller (yes, there will be more space next time) and a good, great and wonderful time was had by just about everyone! You've seen me write often about CoCo Community. Well, RAINBOWfest was CoCo Community at its finest. There were thousands and thousands of people there—and what they spoke about for three days running was CoCo. I can tell you, after all the years of proclaiming time and again that CoCo isn't a toy, of beating down rumors (published by some magazines and otherwise) that CoCo was dead, of hearing praises about this computer system and that—RAINBOWfest, and all the people there who truly know the power, capability and have the sincere *love* for their CoCos was, indeed, one of the best moments in my life.

We anticipated a couple thousand people would attend RAINBOWfest and, from that point of view, figured it would be a success. In all, total attendance was somewhere between 10,000 and 11,000. Our seminars were standing room only, the breakfast with Don Inman was a complete sellout. In all it was far, far above any expectations. A veteran show-goer told me he had never seen anything like it in his life! Me either.



I am as proud as can be that we were able to put on RAINBOWfest! And, for the record, I want to say that we will have another one—maybe more than one. Virtually every exhibitor was asking to be able to participate again. And there were a large number of people there who didn't exhibit who plan to be there next time.

I couldn't talk about RAINBOWfest without saying how much all of us owe to Dave Hooper, the local arrangements chairman. Dave truly did it all —and in totally outstanding fashion. There are thousands of people, Dave, who thank you for everything you did to make the show what it was.

There should be praise, too, for Don Inman, our breakfast speaker, who did a marvelous job, and for all our seminar speakers. They included Fred Scerbo of IMB, Tom Nelson of Nelson Software, E. R. Bailey of Micrologic, Dr. Hal Snyder of the Northern Illinois CoCo Club, Steve Bjork, the author of Zaxxon, and Charles Roslund of Elite Software. By the way, Charles is back in *the Rainbow* with his popular *Charlie's Machine* feature.

And the "gang" from here: General Manager Pat Hirsch; Ad Manager Patty King, who was also reponsible for putting things together from this end; Art Director Sally Nichols, Research Assistant Monica Wheat; Managing Editor (and truck driver) Jim Reed; and our "volunteer," Willo Falk, my better half. Too, a very special thanks to Ted Donhauser of ProMar in Chicago. He came to the rescue time and again.

RAINBOWfest brought people from all over—from Great Britian, from Germany, from the Yukon, Hawaii and all across the United States and Canada. It certainly seemed every state was represented. It was a fantastic time and I hope you will make plans to share some fine CoCo Community with us in the future.

So, now, it's Second Anniversary time. I hope you like this anniversary issue, as *the Rainbow* enters its third year. Our big surprise is included, too—the soundsheet that is bound in every issue. We encourage you to try it out; there are some good programs on it! And, then, we would really like to know whether you like this innovation. If you do, we may consider doing it again—or even on a

(continued on page 272)

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BUILDING JULY'S RAINBOW

The Second Anniversary issue . . .
Leaping over the 300-page hurdle . . .
Introducing the Rainbow Soundsheet . . .

Partytime at *the Rainbow!* It's our second birthday. There's been a bit of reverie around here about breaking the 300-page mark and, in a moment of reflection, we made the observation that this month's issue of *the Rainbow* has more pages, by eight, than the entire first year's editions combined. To put it another way, the very first issue of the Rainbow took up both sides of a total of 50 sheets of paper; this month's magazine will use more than two 35-ton boxcar loads of paper. While we grew up in a hurry, we hope to grow old gracefully with our birthday resolution being to emphasize quality, not size.

Size does have its advantages, though. Thanks to the support of all of you and our 203 advertisers, we're able to offer everyone a birthday gift that we're really quite proud of, our *Rainbow* Soundsheet sampling of programs from our birthday issue. If you haven't already, do give it a spin.

Another birthday special is "Two Years of *Rainbow*," a complete index — by subject and by author as well — of all the articles, programs, reviews and special features appearing in *the Rainbow* between July 1981 and June 1983. Many of you have been asking for this reference piece, and we plan to make it an annual anniversary feature.

Another index, of sorts, and what we hope will become an active, evolving reference work, is Bob Russell's Color Memory Map. This valuable compilation of "hooks" and "addresses" is being presented in installments over the next few months. Even if you aren't among those who are excited to get this otherwise unavailable information, do hang onto it because, as you continue to learn more about BASIC, you'll develop a need for and appreciation of it.

Among our many happy returns in this anniversary special are Charles J. Roslund, who's back with his popular *Charlie's Machine* and Fred Scerbo, who returns to our pages with *Snail's Revenge*, the long-awaited sequel to his *Snail Invaders* (February 1982).

Moving right along, from snails to turtles, new this issue is *Greetings From Uncle Bert,* with Dale Peterson, our new column on LOGO, directed to kids and parents, too.

Also new this issue is the TRS-80 MC-10 Micro Color Computer! Editor Lonnie Falk provides a preview of this 4K "Coquette?" in our Pipeline column.

And, speaking of our founder/editor/-guiding light/driving force, since this is a festive occasion for *the Rainbow*, and even though the big get-together and celebration took place at RAINBOWfest, I want to take this opportunity to salute the boss. In speaking of Lonnie Falk during his after-breakfast address at RAINBOWfest, Don Inman spoke of a man "with stars in his eyes and visions of rainbows in his mind," and that's very true of Lonnie. Later in his talk, Don said he likes to think of himself as, not an expert, but a "beginner in each field and (I) plan to stay that way forever." He was also describing Lonnie Falk, whose creative spirit is kindled by an almost childlike fascination for the new, the different, the unexplored. Nobody is happier than Lonnie Falk when he has a newly-delivered box to open and still another set of instructions to read. If Lonnie ever found the rainbow's end, he wouldn't linger at all, but would immediately begin looking for another rainbow. Without getting too soupy, Lonnie, keep on chasing rainbows, the chase is all the fun.

—Jim Reed

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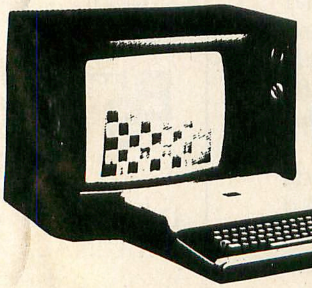

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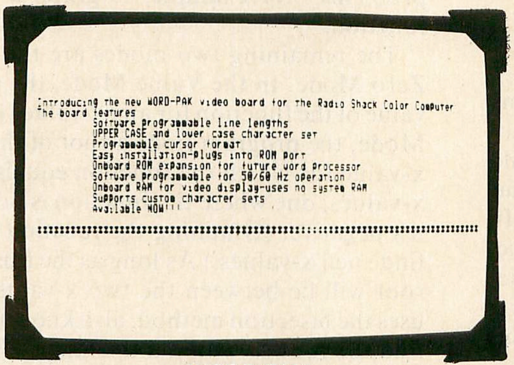

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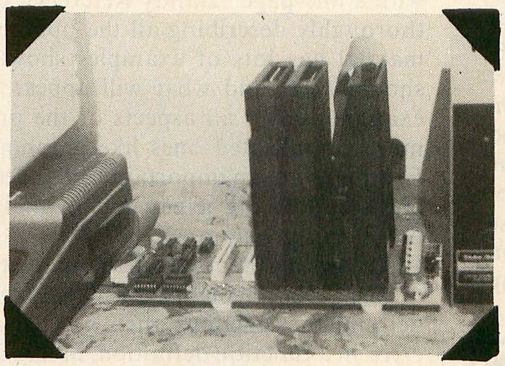

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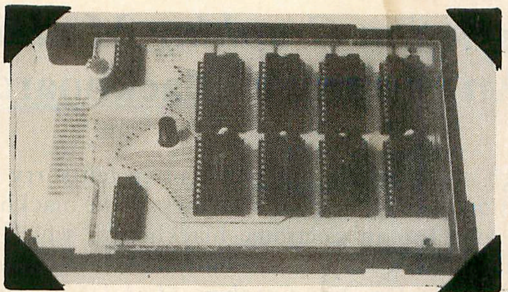

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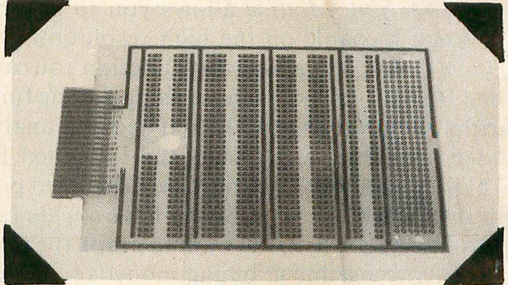

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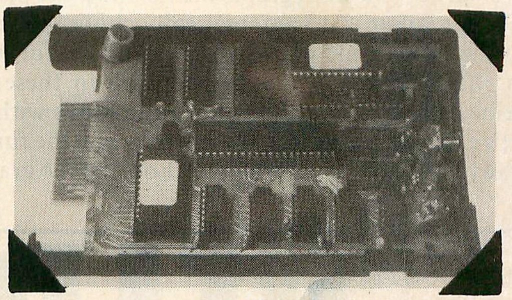

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Function Graphing Module
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I teach mathematics and I have often felt sorry for my students because of my poor drawings on the blackboard. I have wished for an electronic blackboard, which would graph functions at the press of a button. At last, my wish has come true, with *Function Graphing Module* from Calcsoft.

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The documentation that comes with the program is superb! There are over 50 pages of documentation, along with a one-page "Handy Reference Guide." In addition to thoroughly describing all the options of the program, the manual has lots of examples showing exactly what you should type, and what will appear on the screen. These examples cover all aspects of the program, including the more complicated ones like graphing multiple functions. Examples are an important tool in learning, and the examples here are a big help in understanding how to get the most out of this program.

An unusual feature of the manual is the chapter titled "Crash!" Since you provide part of the program in the lines defining the functions, there's a chance you'll have a syntax error in a function definition, or a function that will require a division by zero, or some other illegal operation. The manual explains this thoroughly, and helps you avoid crashes by giving numerous examples showing correct syntax. If you crash the program anyhow, the manual gives instructions on how to recover.

One suggestion for improving the manual: a table of contents and page numbers would help.

Function Graphing Module performs flawlessly, and clearly has been designed with the user in mind. The functions have been well-chosen, and the documentation is excellent. This is an outstanding product.

(Calcsoft, P.O. Box 401, St. Ann, MO 63074, 16K ECB, $19.95)

—David Finkel

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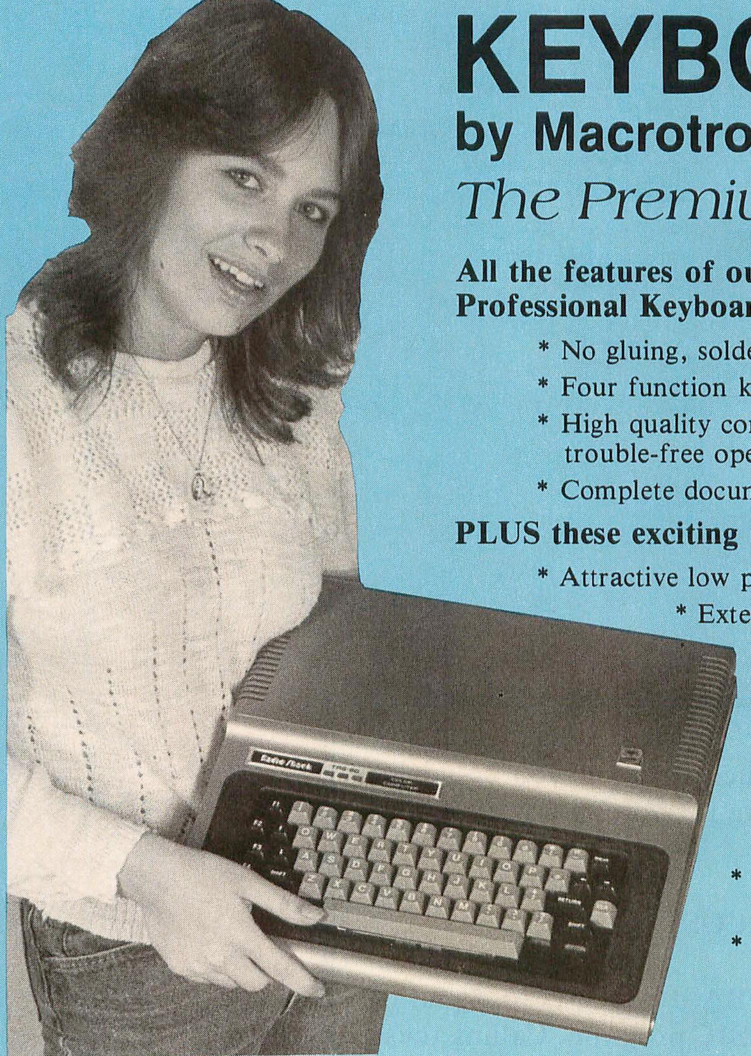

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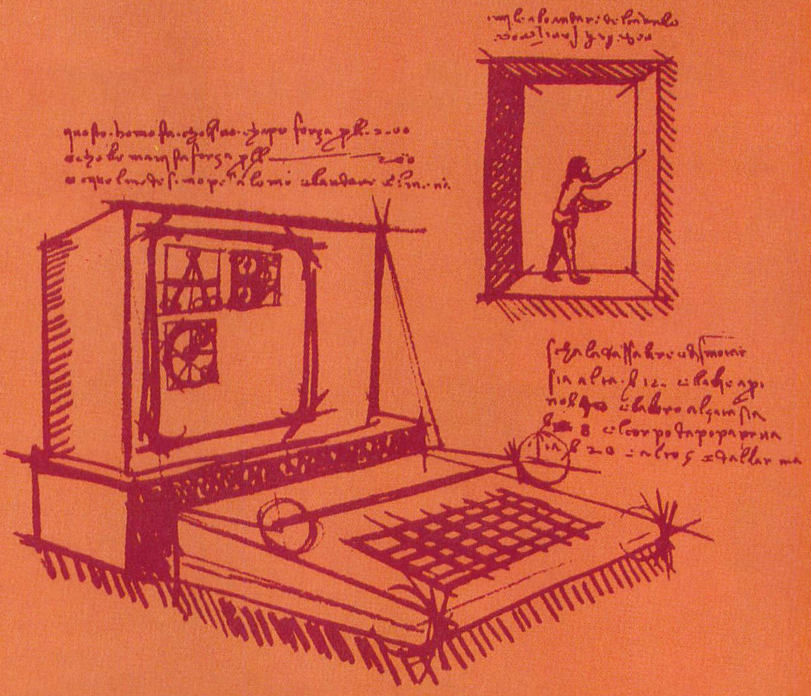
ROM CALLS

THE EASY WAY



By C. J. Roslund

When programming in machine language, there are many times when life would be much easier if you could let BASIC take care of something for you. A few examples that come to mind are:

*Writing data files to cassette or disk
*Doing real math calculations (ie, SIN, COS)
*Drawing complex graphics

There are, of course, routines in the BASIC ROMs to do all of these, since they can be done from a BASIC program. Calling these ROM routines from your own machine language program has typically taken a lot of studying of the BASIC ROMs to discover exactly how to call the routine you need and also what parameters need to be initialized prior to calling the ROM routine. Another concern must always be if the entry point you use will be the same in all releases of the BASIC ROMs. I am going to present a method of making ROM calls I have developed that will allow you to call any ROM routine that has a BASIC command counterpart. For example: *PRINT, LINE, CIRCLE, OPEN, CLOSE, CLEAR,* etc. You will only need to know one ROM entry point (which I will give you) to call any of these routines.

The idea behind this method of making ROM calls is to trick the computer into thinking it is running a BASIC program in the middle of your machine language program. If you can do this, and point the BASIC interpreter to the BASIC command line of your choice, you can let the BASIC interpreter do all the work for you. You only need to create what looks like a BASIC command line in the middle of your program. For example: PRINT"IT WORKS." The first thing

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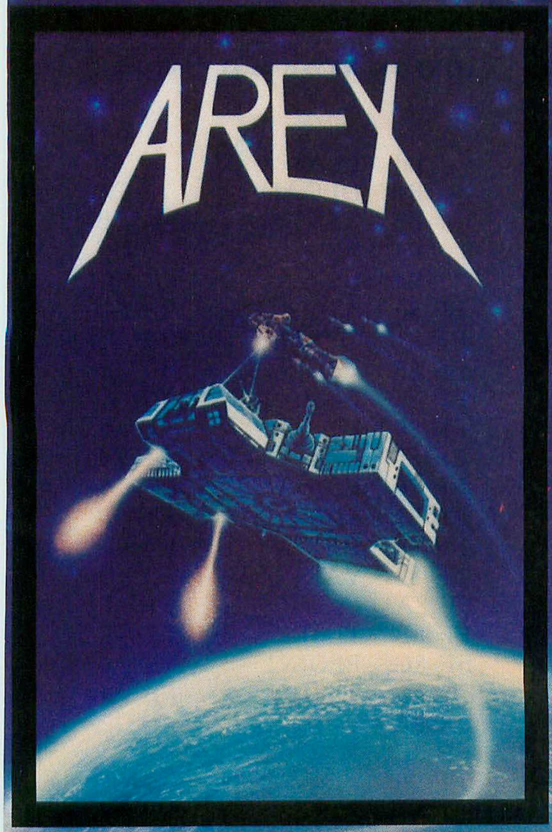

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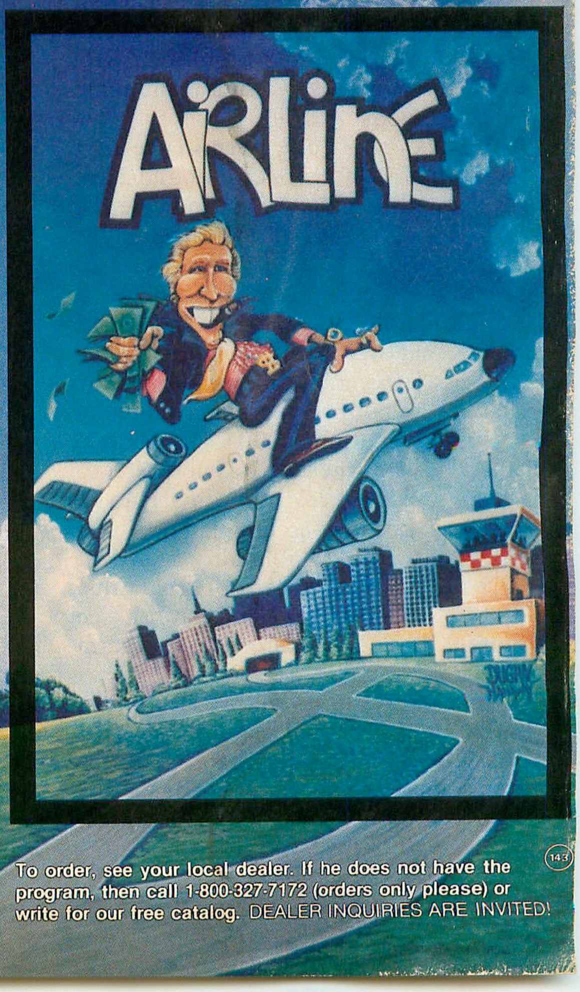

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you must know is how BASIC "Tokenizes" all key words. Key words, such as *PRINT, OPEN, LINE,* etc. are stored in memory as a one byte token. This conserves memory, and speeds execution of a BASIC program. An example of this tokenizing follows:

(Numbers in parentheses represent hex token values. All other characters represent their equivalent ASCII value.)

untokenized: PRINT
"IT WORKS"
tokenized: (87) "IT WORKS"

When creating the BASIC command line in the middle of your machine language program, you must use the TOKENS for all BASIC key words and functions. Table 1 provides a key word vs. token table for your use in creating a tokenized BASIC command line. (Token values are listed in hex.) These are the values to use in place of key words listed. Note that the token for *PRINT* is hex 87 as was used in the above example.

The program listing accompanying this article (named *ROMCALL)* provides all initialization required to make ROM calls with this technique. It contains two sample ROM calls to the print and real math routines. A line by line explanation of the program follows. *ROMCALL* is written in position independent code, and will work with all versions of the BASIC ROMs in Color BASIC, Extended BASIC, or Disk BASIC computers. It uses only one ROM entry point in the Color BASIC ROM, and this entry point is the same in all versions.

Line numbers are given in the first column of the listing. Lines 1 and 2 are assembler directives. They indicate the program name and start the assembly at address $3000.

Program execution begins at line 3 with the lable *Start.* Lines 3 and 4 load the X register from the direct page address $A6 and push this value on the stack. $A6 contains a pointer (actually stored in locations $00A6 and $00A7) that is used by the BASIC interpreter to keep track of its location in a BASIC program or direct command line. Later in my program I will modify $A6. Just to be safe, I am saving the original value of this pointer so that I can restore it (see lines 9, 10 and 11) before the program terminates.

Lines 5 and 6 do all preparation to make the first sample call to the ROM routine "SIN." A pointer to the tokenized command string "A=SIN(1)" is loaded into the X register and a branch to the subroutine "BASIC" is made.

Table 1
Key-Word vs. Token

KEY-WORD	TOKEN	KEY-WORD	TOKEN	KEY-WORD	TOKEN
FOR	80	AND	B0	PLAY	C9
GO	81	OR	B1	DLOAD	CA
REM	82	>	B2	RENUM	CB
'	83	=	B3	FN	CC
ELSE	84	<	B4	USING	CD
IF	85	SGN	FF 80	ATN	FF 94
DATA	86	INT	FF 81	COS	FF 95
PRINT	87	ABS	FF 82	TAN	FF 96
ON	88	USR	FF 83	EXP	FF 97
INPUT	89	RND	FF 84	FIX	FF 98
END	8A	SIN	FF 85	LOG	FF 99
NEXT	8B	PEEK	FF 86	POS	FF 9A
DIM	8C	LEN	FF 87	SQR	FF 9B
READ	8D	STR$	FF 88	HEX$	FF 9C
RUN	8E	VAL	FF 89	VARPTR	FF 9D
RESTORE	8F	ASC	FF 8A	INSTR	FF 9E
RETURN	90	CHR$	FF 8B	TIMER	FF 9F
STOP	91	EOF	FF 8C	PPOINT	FF A0
POKE	92	JOYSTK	FF 8D	STRING$	FF A1
CONT	93	LEFT$	FF 8E		
LIST	94	RIGHT$	FF 8F	**DISK BASIC**	
CLEAR	95	MID$	FF 90		
NEW	96	POINT	FF 91	DIR	CE
CLOAD	97	INKEY$	FF 92	DRIVE	CF
CSAVE	98	MEM	FF 93	FIELD	D0
OPEN	99			FILES	D1
CLOSE	9A	**ENTENDED BASIC**		KILL	D2
LLIST	9B			LOAD	D3
SET	9C	DEL	B5	LSET	D4
RESET	9D	EDIT	B6	MERGE	D5
CLS	9E	TRON	B7	RENAME	D6
MOTOR	9F	TROFF	B8	RSET	D7
SOUND	A0	DEF	B9	SAVE	D8
AUDIO	A1	LET	BA	WRITE	D9
EXEC	A2	LINE	BB	VERIFY	DA
SKIPF	A3	PCLS	BC	UNLOAD	DB
TAB(	A4	PSET	BD	DSKINI	DC
TO	A5	PRESET	BE	BACKUP	DD
SUB	A6	SCREEN	BF	COPY	DE
THEN	A7	PCLEAR	C0	DSKI$	DF
NOT	A8	COLOR	C1	DSKO$	E0
STEP	A9	CIRCLE	C2	CVN	FF A2
OFF	AA	PAINT	C3	FREE	FF A3
+	AB	GET	C4	LOC	FF A4
-	AC	PUT	C5	LOF	FF A5
*	AD	DRAW	C6	MKN$	FF A6
/	AE	PCOPY	C7	AS	FF A7
^	AF	PMODE	C8		

Let me skip to lines 12 through 16 next. This is where the actual ROM call is made. First, line 12 stores the pointer to the command string (X register) in direct page address $A6. Next the A register is loaded with the first byte of the command line (LDA ,X). Line 14 clears the carry flag bit in the condition code register. This is required to signal the BASIC interpreter that a command line to execute follows. The other possibility is that a BASIC program line, with a line number, was being entered into memory. In this case, the BASIC interpreter would only store the line in the BASIC program storage area, not execute it. Line 15 makes the ROM call to execute the command line pointed to

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by $A6,$A7. This ROM call is a subroutine in the Color BASIC ROM that is called by BASIC's main command interpretation loop. The main command interpretation loop calls $ADC6 when it is all set to execute the next command in a BASIC program, or in a direct command. Upon entry, it assumes that $A6,$A7 is pointing to the next BASIC command to execute, and that the A register contains the first byte of that command. After the ROM call returns, line 16 of this subroutine returns program control to the calling routine with an RTS. This subroutine, named BASIC, is the real key to making ROM calls. It may be called from any part of your machine language program to make a ROM call. The only entry requirement is that the X register must point to the tokenized BASIC command line that is to be executed.

Now back to the rest of the program. Lines 7 and 8 make a sample call (in the same manner as lines 5 and 6) to the ROM routine "PRINT."

Lines 9, 10 and 11 restore the original contents of the pointer $A6,$A7, and then return to the main calling program. This is the end of my sample program so this RTS will return to BASIC and the OK prompt.

Line 17 is where the tokenized BASIC command string is stored. This line was created as follows:

$41	ASCII value for letter "A"
$B3	Token for math operator "="
$FF,$85	Token for function "SIN"
$28	ASCII value for left paren. "("
$32	ASCII value for number "1"
$29	ASCII value for right paren. ")"
$0	Line terminator

Put them all together they spell A=SIN(1)

Line 18 stores a similar construction of the BASIC command PRINT A:

$87	Token for PRINT
$41	ASCII value for letter "A"
$0	Line terminator

Line 19 is an assembler directive that ends assembly and indicates to the assembler the address of the program entry point.

This completes the description of *ROMCALL* operation. Now I will point out some cautions you should observe when making ROM calls with this method. First, *CLOADM* and *CSAVEM* cannot be called in this manner. I will describe changes to this program to call these ROM routines at the end of the article. Second, BASIC does memory available checks during many of these ROM calls. BASIC defines available memory as the space from where the free memory pointer is pointing up to the stack pointer register. (Free memory pointer is located at $1F,$20.) If your program has moved the STACK pointer very low in memory, BASIC may think you are out of memory (during a ROM call) and terminate your program with the familiar OM ERROR message. Third, if you define any numeric or string variables, BASIC will store them where it thinks variable storage and string storage have been allocated. You should not have any other important data here or it will be written over. Variable space is defined by the pointers located at the following addresses:

$1B,$1C	Start of simple variables
$1D,$1E	Start of array variables
$1F,$20	Start of free memory
$21,$22	Bottom of string storage space
$27,$28	Top of string storage space

These cautions can be summarized as follows: You must make sure your program stays away from memory used by BASIC, and be careful not to do anything that will prevent BASIC from being able to run (moving stack pointer so low that an out of memory error occurs, for example). You may make ROM calls to the routines *CLEAR, PCLEAR, FILES,* and DIM to modify the BASIC variable space pointers as you wish.

The two commands *CLOADM* and *CSAVEM* may be called with one change to the program given. This change is necessary because the BASIC interpreter handles the two commands as special cases in the main command interpretation loop, mentioned earlier. If BASIC sees a *CLOAD* or *CSAVE* token to execute, it does not call the ROM routine at $ADC6. Instead, it calls a routine at $8C62 for *CLOAD,* or $831A for *CSAVE.* Therefore, to call *CLOADM* you must change line 15 to read JSR $8C62. To call *CSAVEM* you must change line 15 to read JSR $831A. The command string token for *CLOADM* or *CSAVEM* is created with the token for *CLOAD* or *CSAVE* followed by the ADCII value of "M" ($4D).

I have not personally tried every possible ROM call using this method. If anyone finds one that does not work, I would be glad to hear from you, and offer some assistance if I can. From studying my disassembly of the BASIC ROMs, this method should work with any BASIC command that can be executed from within a BASIC program.

If you *EXECUTE* the sample program *ROMCALL,* you will be making ROM calls to the following BASIC commands:

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The listing:

```
PAGE 0001               ROMCALL             by: CHARLES J ROSLUND

                        * ROM CALLS MADE EASY *
                        ***********************
0001 0E00                      NAM ROMCALL
0002 0E00                      ORG $3000       START CODE ANYWHERE (PIC)

                        *  INITIALIZATION  *
                        ********************
0003 3000 9EA6          START  LDX <$A6
0004 3002 3410                 PSHS X          SAVE PROGRAM POINTER

                        *  SAMPLE CALLS  *
                        ******************
0005 3004 308D0017             LEAX MATHS,PCR  MATH STRING
0006 3008 8D0B                 BSR BASIC

0007 300A 308D0019             LEAX PRNTS,PCR  PRINT STRING
0008 300E 8D05                 BSR BASIC

                        * FIX POINTERS BEFORE EXITING *
                        *******************************
0009 3010 3510                 PULS X
0010 3012 9FA6                 STX <$A6        RESTORE POINTER
0011 3014 39                   RTS

                        * EXECUTE COMMAND STRING SUBROUTINE *
                        *      X POINTS TO TOKEN START      *
                        *************************************
0012 3015 9FA6          BASIC  STX <$A6        POINT TO STRING
0013 3017 A684                 LDA ,X          GET TOKEN
0014 3019 1CFE                 ANDCC #$FE      FLAG NOT A LINE #
0015 301B BDADC6               JSR $ADC6       CALL BASIC
0016 301E 39                   RTS

                        * CONSTANT STRING AREA *
                        ************************

                        *      A=SIN(1)        *
0017 301F 41B3FF8528    MATHS  FCB $41,$B3,$FF,$85,$28,$31,$29,0
                                         A=SIN (1)

                        *      PRINT A         *
0018 3027 874100        PRNTS  FCB $87,$41,0
                                   PRINT A

0019 302A                      END START

NO ERRORS FOUND
```

A=SIN(1)
PRINT A

You should see the floating point representation of SIN(1) displayed on your screen. Readers with assemblers can simply enter the source code from the listing and assemble it. If you don't have an assembler, you may *POKE* the hex values from the program listing (third column) into any free memory space. A monitor would make this job a lot easier. I located this sample program at $3000. If you *POKE ROMCALL* into memory by hand, be sure to poke all eight values in line 17 (following the FCB) into memory. Only the first five are listed in column three due to the column width allocated.

Hint . . .

I would like to pass on a helpful hint for single disk drive owners to use when backing up a disk. Use

PCLEAR (ENTER)
FILES (ENTER)
BACKUP (ENTER)

This will speed up the process and make fewer disk switches necessary. I use this all the time and have never had a problem doing so.

Jim Lemaster

PARALLEL PRINTER INTERFACE

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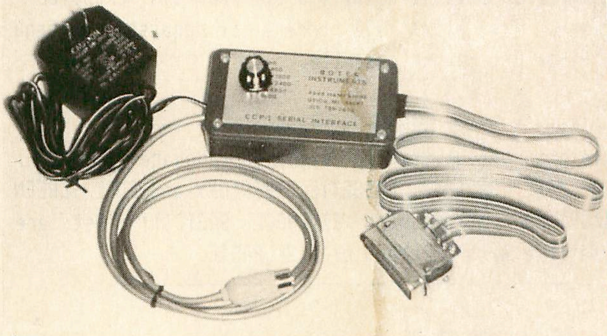

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Data Communications Tutor Does the Job

In case you've ever wondered what magic is involved when two computers hold a conversation, the folks at Computerware have a tutorial program which is designed to teach a beginner the basic ideas and terminology involved in computer generated data communications.

Called, appropriately enough, *Introduction to Data Communications*, this instructional program, supplied on cassette or disk, is divided into five lessons so it can be loaded into 16K 80Cs. The first four parts are the instructional material which is presented one page at a time with about 15 screen pages per "lesson."

Colorful graphics are interspersed in the lessons showing visual examples of the material. For example, the material on acoustic modems has an illustration of a CPU, acoustic modem and a telephone handset suspended over the modem. Very nice use of the CoCo's graphic capabilities. The fifth section is a 10-question exam which determines what you have retained from the first four lessons. At the end of the test you are graded and to the chagrin of those not paying attention—critiqued. Just like my old school marm, Mrs. Grundy, nasty comments are given to those underachieving, suggesting a review of the material.

The lessons are written by Computerware to be specifically applicable to transmitting and receiving data over telephone lines with the 80C.

Topics covered are:

- Definitions of data communications
- Examples of its uses
- Block diagram of a simple circuit
- The RS-232 Interface
- An explanation of the RS-232 signal
- Types of modulation
- Telephone line frequencies and level specs
- Baud and BPS
- Start and stop bits
- Asynchronous data

The lessons are presented in a concise manner on the screen. Each screen is advanced by the user at his own pace. Unfortunately, you cannot "back up" to review the material from previous pages without rerunning the program. The lessons auto-load from one series to another so the separation of the material into five parts is not a problem in use.

While Computerware has done a fine job of summarizing the basics of data communications relating to the 80C, I can't help but think that information of this type could be more effectively presented in a printed booklet. The student would be able to page back and forth to review the data.

For those who are interested in learning the basics of data communications through interaction with their CoCo, *Introduction to Data Communications* is the program.

(Computerware, Box 668, 4402 Manchester Ave., Suite 102, Encinitas, CA 92024, $17.95 on tape, $22.95 on disk)

—Bruce Rothermel

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ESCAPE

A 3-D GRAPHICS ADVENTURE WITH SOUND
(Machine Language for Fast Action)

This is NOT the usual "find the treasure" adventure. In **ESCAPE**, you are trapped on the top floor of a skyscraper and the only way out is by using a very unusual elevator. You must give the elevator the correct code or else the ride down is a real killer. The maze-like halls seem to come to life due to the fantastic 3-D graphics. Search the halls for rooms which contain clues to the correct code. Clues must be deciphered to learn the elevator's secret code. Game times depends on the skill of the player, but it is typically 8-10 hours. **ESCAPE** is suitable for group play. A mentally stimulating experience.

16K BASIC $18.95

RECIPE FILE

A CASSETTE BASED STORAGE AND RETRIEVAL SYSTEM

This program permits storage of your favorite recipes for retrieval by your computer. Once a recipe has been recalled, then the computer can adjust the ingredient measure for serving the desired number of persons. Each recipe can contain special comments on preparation as well as the full instructions for using the recipe. Included is a line oriented text editor for creating and editing the variable length files. Completely menu driven and very user friendly. Easily modified by the user for use in keeping track of record, coin or stamp collections or whatever your interest. Screen or printer output.

16K Ext. BASIC $21.95

SPECIAL: *A collection of 30 recipies covering main meals to snacks. Only $3.95 with program.*

SQUIRE

SQUIRE is a challenging game of asset management. The player must manage a country estate and contend with crop failure, investment losses, taxes and other such headaches. The object of the game is to increase the estate's value while providing for the peasant workers. The starting assets are computer selected so that each game offers different challenges. Great experience for the kids or aspiring executives.

16K Ext. BASIC $14.95

HOUSEHOLD EXPENSE MANAGER

This menu driven program package is designed for creating and maintaining a data file on cassette of 30 household expense categories for a 12-month period. It also keeps cumulative totals and a separate total of tax deductable expenses. A comparative analysis program provides a graphic presentation of relative expenses between any two months during the year. The user can change categories by modifying program code. Screen or printer output.

16K Ext. BASIC $19.95

FLIPPER

A fun and challenging version of the Othello™ type board games. This version includes options for play solely by the computer, one player against the computer, or two players against *each* other. The computer can play on four skill levels. Very colorful with plenty of sound. Fun for kids and challenging for adults. Great for parties.

16K Ext. BASIC $16.95

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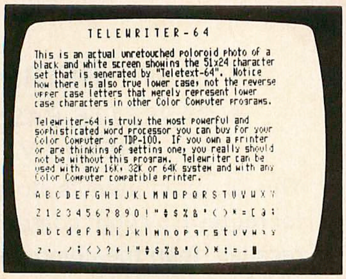
TELEWRITER-64

Colorware researched the word processors available for the Color Computer. We came to the very same conclusion that so many review articles have! Telewriter-64 is, by far, the superior word processor for the Color Computer.

Why is Telewriter so much better than the others? For one thing, it has overcome the 32x16 character display limitation of the Color Computer. No small feat, Telewriter accomplishes this by generating its own set of characters in software. You select 51x24, 64x24 or 85x24 character displays by merely issuing a format command. If you have ever used a word processing system, you know how important it is to be able to see a good portion of your text on the screen.



```
               TELEWRITER-64

This is an actual unretouched poloroid photo of a
black and white screen showing the 51x24 character
set that is generated by "Teletext-64".  Notice
how there is also true lower case, not the reverse
upper case letters that merely represent lower
case characters in other Color Computer programs.

Telewriter-64 is truly the most powerful and
sophisticated word processor you can buy for your
Color Computer or TDP-100.  If you own a printer
or are thinking of getting one, you really should
not be without this program.  Telewriter can be
used with any 16K, 32K or 64K system and with any
Color Computer compatible printer.

A B C D E F G H I J K L M N O P Q R S T U V W X Y
Z 1 2 3 4 5 6 7 8 9 0 ! " # $ % & ' ( ) * = [ @ ;
a b c d e f g h i j k l m n o p q r s t u v w x y
z , . / ; < > ? + ! " # $ % & ' ( ) * : = - █
```

Telewriter-64 also generates true lower case characters. This is much preferable to the reverse characters that merely "represent" lower case letters in other co-co word processors.

Telewriter-64 is feature packed. Besides the standard features found in any word processor, Telewriter also includes: user-friendly full-screen editing, rapid cursor and scrolling control, page jump, right justification, menu-driven disk or cassette access, compatability with spelling checkers (such as Spell-and-Fix), and a clever double check that asks the user "Are you sure?" before executing any operation that would kill any sizeable amount of your text.

Telewriter-64 runs on any 16K, 32K, or 64K system (extended Basic not required) and works with any printer. It has all of the control codes necessary to take full advantage of all of the features in any printer. There is even a "typewriter" mode which sends typed lines directly to your printer.

With advanced word processing software such as this, your color computer becomes a truly powerful word processing system, *with a* price that makes sense for the personal user.

Beyond impressive capability, Telewriter-64 simply makes any kind of writing a pleasure. It is a truly sophisticated system that is marvelously easy to learn and enjoyable to use.

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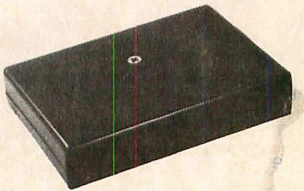

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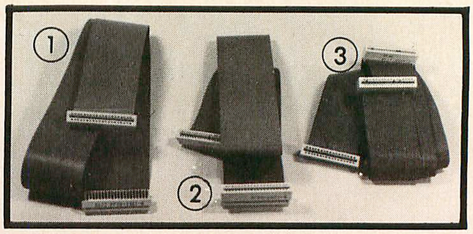

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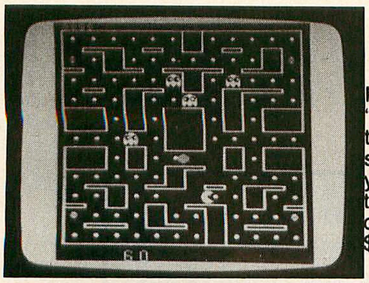


GHOST GOBBLER

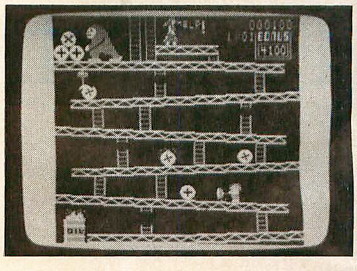
From Spectral Associates, this "Pac" theme game is the best of it's type. Brilliant color, action and sound, just like an arcade gobble your way to glory, but watch for those ghosts! Get in on the wild fun of this game craze now. Tape: $21.95, Disk: $25.95

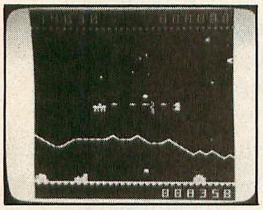
GHOST GOBBLER

DONKEY KING

DONKEY KING

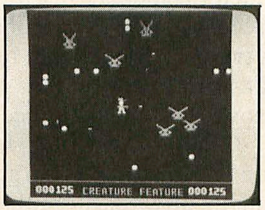
You simply can not buy a more impressive game for your color computer than this new wonder from Tom Mix. The graphics, sound, and animation are all just astonishing! There are four different graphic screens and each is endless fun. Requires 32K. Tape: $24.95, Disk: $27.95





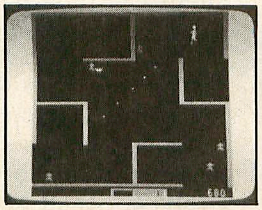
PROTECTORS

There are several good versions of the "Defender" theme available for the CoCo. None, however, rival this one from Tom Mix. No other game matches the detailed graphics and sheer excitement of this top seller. Requires 32K. Tape: $24.95, Disk: $27.95



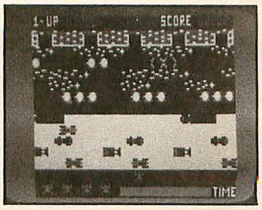
CREATURE FEATURE

From Color Software, comes a lightening swift shoot & dodge the enemy game. It's clever cross between "Robotron" and "Beserk" themes, with bullets flying everywhere. Solid, shoot-em-up-fun. Requires 16K. Tape: $17.95. Disk: $19.95



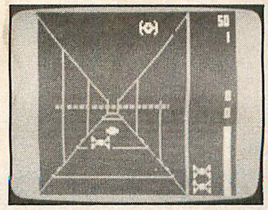
ANDROID ATTACK

Spectral Associates' very well done "Berserk" type game with some interesting added features. Each cassette contains both the 16K and 32K version. The 32K version has voice output! Plenty of action. Tape: $21.95



FROGGER

Just released by The Cornsoft Group, this is the officially licensed version from Sega, the arcade manufacturer. It has it all! 4 lane super highway, snakes, turtles, logs, alligators, etc. Lots of action and laughs! Requires 16K. Tape: $19.95



INTERGALACTIC FORCE

Your space fighter roars into the Death Corridor. Lock-on and blast the enemy fighter from the sky. Now try dropping one into Death Star's narrow exhaust vent. It takes skill and guts. Good luck! With "Star Wars" theme song. From Anteco. Tape: $24.95

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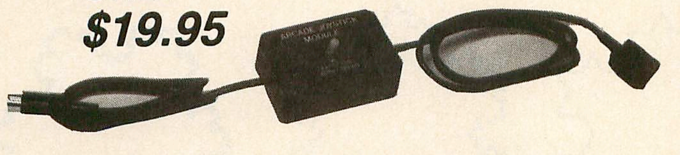

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VIDEO COMMAND

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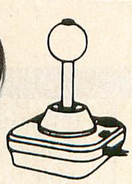

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FASCINATING FRACTALS

Geometry of Nature

By Robert Delbourgo

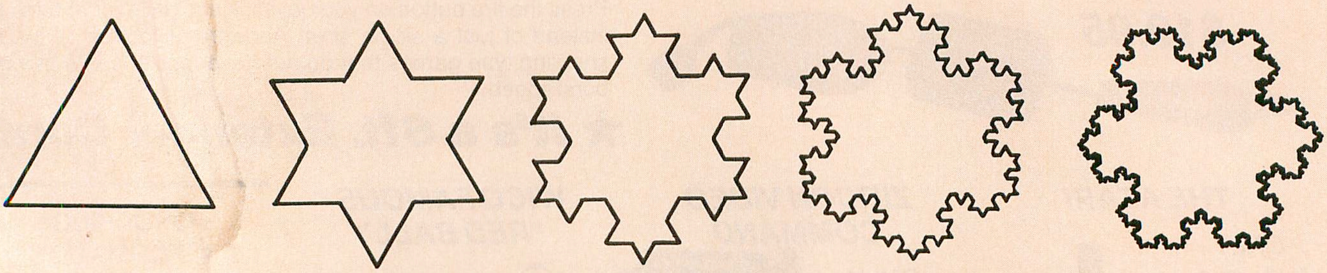
Don't read any further. Just take a long hard look at the figure below. It is probably the most famous example of a "fractal" shape and is named the "Koch Snowflake" after its discovery by von Koch in 1904. Notice that each successive stage in the construction of the flake involves the addition of equilateral triangles (scaled down by 1/3) along every segment of the perimeter; put another way, the perimeter is increased self-similarly by an extra 1/3 at every consecutive stage. We probably agree that the fractal flake is a very beautiful shape, but you may be surprised to learn that until recently it was regarded as a mathematical monstrosity, to be shunned by any self-respecting scientist. The change in attitude, from monstrosity to curiosity to conventionality, is largely due to the efforts of Benoit Mandelbrot who, more than anyone, has put the subject on a respectable basis and showed its significance for describing the real physical world.

We'll be drawing some regular fractals shortly on the 80C but before we start let us see why fractals are so "odd" and therefore so fascinating. If you examine the stages in the snowflake construction, you will notice that the perimeter increases without limit as $(4/3)^n$, where N (which tends to infinity) stands for the stage you have reached. Yet the area of the flake stays perfectly finite! This is the first queer feature of a fractal and you should contrast it with commonplace geometrical figures where the perimeters are finite and simply go up as the square root of the enclosed areas. The second thing to notice is that more and more corners are introduced with each consecutive stage in the construction; in the end so much jaggedness is introduced that it is impossible to draw a line which grazes the boundary anywhere. In the mathematical jargon, no tangents to the boundary curve exist—again this is quite contrary to our experience with ordinary geometrical shapes. Summarizing,

1) Boundaries of true fractals are infinite in extent,

2) No tangents may be drawn anywhere along a fractal boundary.

Notwithstanding these difficulties, Mandelbrot has shown that such behavior is quite natural in many physical settings



(Robert Delbourgo, a professor of Physics, and his schoolboy sons Tino, 13, and Daniel, 11, started computing as a hobby with the purchase last year of a CoCo.)

(e.g. the shape of a coastline, or the human vascular system) and he has put the idea on a firm mathematical foundation. I strongly urge you to read his magnificent book, *Fractals, Form, Chance and Dimension*, if you want to delve more into the topic. It is written mainly for non-experts and contains many striking examples of fractals, both regular and random, as well as a complete list of references.

There are four programs for your delectation, Fractals 0 to 3. The first is based on circles, the second on spokes, the third on cornered polygons and the fourth on edged polygons. Although they are somewhat different from one another, I suggest that you start by typing only two of them first; say Fractal 1 and Fractal 3. If you like what you see, carry on with the other two. Let me describe the main points about the programs for those of you who want to understand them more fully.

Listing: Fractal 0

Lines 1-7 provide the Title Card comprising Fractal Trees.
Lines 8-9 give instructions.
Lines 10-24 draw the circles in ever smaller radii (ratio of PI/N). Note the dimensioned arrays which locate the centers.
Lines 25-20 freeze and paint (if needed) the final fractal shape.

Listing: Fractal 1

Lines 1-7 produce a Fractal Root System as the title card.
Lines 8-29 give instructions, drawing routine and final painting in order. This time the basic shape is a spoked figure and for aesthetic reasons the ratio of successive radii is 3.3/N.

Listing: Fractal 2

Lines 1-8 give a Fractal Cornered Square.
Lines 12-25 will draw the closed polygons at the corners of earlier ones. Here successive ratios are 3/(N+2) to keep the shapes within the confines of the screen.
Lines 26-30 for freezing the picture.

Listing: Fractal 3

Lines 1-7 produce a Title Card of a Fractal Edged Square.
Lines 11-28 draw the polygons, which touch along their sides this time. It is necessary to reposition the centers in this operation and this is carried out at the end of Lines 17, 20 and 24.

In all of these programs I have assumed that your computer is 16K ECB, which is why I have restricted the ranges of N values in the dimensioned arrays. Those of you with greater memory may like to relax these ranges. For instance, in the first listing, 32K people can change Line 19 to having *N>12 and Line 22 to having N>6*, etc. One last suggestion: Try randomizing your fractals by varying the directions arbitrarily in the several programs. For instance, changing Line 16 in Fractal 0 to

```
16 FORI=1TON:E=(RND(99*N))/99:A(I)=128+R*COS
   (2*PI*E/N): U(I)=96+R*SIN(2*PI*E/N):CIRCLE
   (A(I),U(I)),R*PI/N,1:NEXTI
```

and make similar changes to Lines 18, 21, 24. Do you think that your final figure resembles a real map of a landscape?

```
5.......01C1
18...... 046F
END ... 0604
```

Listing 0:

```
1 CLS:PRINT@3,"fractals 0  by r.
delbourgo";:PRINT@480,"15 willow
dene av, australia7005";
2 FORI=0TO32STEP32:FORJ=232TO247
:POKE1024+I+J,128:NEXTJ,I:FORI=0
TO1:FORJ=134TO358STEP32:POKE1024
+I+J,128:POKE1042+I+J,128:NEXTJ,
I:FORI=0TO7:FORJ=99TO387STEP288:
POKE1024+I+J,128:POKE1042+I+J,12
8:NEXTJ,I
3 FORI=0TO27STEP9:FORJ=0TO64STEP
32:POKE1090+I+J,128:POKE1378+I+J
,128:NEXTJ,I
4 FORI=33TO35:FORJ=0TO288STEP288
:FORK=0TO27STEP9:POKE1024+I+J+K,
140:POKE1152+I+J+K,131:NEXTK,J,I
5 FORI=32TO160STEP128:FORJ=0TO28
8STEP288:FORK=0TO27STEP9:POKE102
4+I+J+K,138:POKE1028+I+J+K,133:N
EXTK,J,I
6 FORJ=64TO352STEP288:FORK=0TO27
STEP9:POKE1024+J+K,139:POKE1028+
J+K,135:POKE1088+J+K,142:POKE109
```

CASSETTE CONTROLLER

NEW

Allows you to hear your cassettes without unplugging cables. Switch knob between AUTO and MANUAL positions. $25.00

SERIAL SWITCHER

Switch your serial port between two or three peripherals. 2 - Port. . . . . $25.00 3 - Port. $30.00

TOTALLY SOLDERLESS KITS

4K - 16K	**$20.00**
16K - 32K	**$35.00**
4K - 32K	**$50.00**

All memory upgrades come complete with 16K or 32K button, easy-to-follow instructions, and 90-day unconditional warranty.

PILOT LIGHT— Includes 5 different colored lenses, and simple instructions. Mounts in 5 minutes to top cover of your computer. With Lifetime Warranty, only $7.00

I.C.s

6809E CPU	**$25.00**
6883 SAM	**$25.00**
6847 VDG	**$20.00**
6821 PIA	**$8.00**
Full Set	**$65.00**

★ FREE ★
CATALOGUE

CABLES

Direct Coax to TV-3', 6', 9', 12'	**$10.00**
* Serial M to M	**$7.00**
Serial M to M, coiled - 5'	**$7.00**
* Serial Ext. M to F	**$7.00**
* Cass. Ext. M to F	**$7.00**
Cass. Ext., coiled - 5'	**$7.00**
* Joystick Ext. M to F	**$7.00**

*Prices shown are for 6 feet. Extra length, add 50¢ per ft.

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Orange, CA. 92669

VT VIDTRON

```
2+J+K,141:NEXTK,J
7 PLAY"L2003CEG04C03GECP1"
8 POKE65495,0:CLS:PRINT@352," AF
TER THE DRAWING IS FINISHED   YO
U WILL HEAR A SOUND. PRESS    <P
> TO PAINT OUT SURROUNDS OR   <C
> TO CONTINUE.":PRINT@0," ENTER
MULTIPLICATION RATE OF    CIRCLE
S (ANY INTEGER BETWEEN    4 AND
16)";:INPUTN:PI=3.14159265
9 IFN<4ORN>16THEN8
10 PMODE4,1:SCREEN1,1:PCLS
11 IFN<10THENR=N*7
12 IFN>9ANDN<12THENR=N*5
13 IFN>11THENR=70
14 CIRCLE(128,96),R,1
15 DIMA(N),U(N)
16 FORI=1TON:A(I)=128+R*COS(2*PI
*I/N):U(I)=96+R*SIN(2*PI*I/N):CI
RCLE(A(I),U(I)),R*PI/N,1:NEXTI
17 R=PI*R/N:DIMB(N*N),V(N*N)
18 FORI=1TON*N:B(I)=A(1+INT(I-1)
/N)+R*COS(2*PI*I/N):V(I)=U(1+INT
(I-1)/N)+R*SIN(2*PI*I/N):CIRCLE(
B(I),V(I)),R*PI/N,1:NEXTI
19 IFN>9THEN25
20 R=PI*R/N:DIMC(N*N*N),W(N*N*N)
21 FORI=1TON*N*N:C(I)=B(1+INT((I
-1)/N))+R*COS(2*PI*I/N):W(I)=V(1
+INT((I-1)/N))+R*SIN(2*PI*I/N):C
IRCLE(C(I),W(I)),R*PI/N,1:NEXTI
22 IFN>4THEN25
23 R=PI*R/N:DIMD(256):DIMX(256)
24 FORI=1TO256:D(I)=C(1+INT((I-1
)/4))+R*COS(PI*I/2):X(I)=W(1+INT
((I-1)/4))+R*SIN(PI*I/2):CIRCLE(
D(I),X(I)),R*PI/4,1:NEXTI
25 SOUND100,1
26 I$=INKEY$:IFI$=""THEN26
27 IFI$="P"THENPAINT(253,96),1,1
:PAINT(3,96),1,1:SCREEN1,0
28 IFI$="C"THENRUN8
29 GOTO26
```

```
8 . . . . . . . 026E
19 . . . . . . 03DF
END . . . 05B0
```

NEW

Shifter

A talking "munch game" for 1 or 2 simultaneous players. Developed by MIT grad in machine language for incredible performance—at fastest speed, you can cross the screen in about 1 second. Shifting maze adds surprises. Players greet each other when meeting. Can select computer as opponent for 1 player.

$20.

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*Add speech to your programs or change dialog in **Shifter**. Digitizes your voice from audio tape; sound track may be put on tape as part of other programs. Comes with Basic callable interface.*

$20.

Both available on cassette for 16 or 32K.Ext. Basic not required. Sticks required for Shifter.

29 ENTERPRISES
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Listing 1:

```
1 CLS0:R=127+16*RND(8):FORI=15TO
495STEP32:POKE1024+I,R:NEXTI:FOR
I=257TO285:POKE1024+I,R:NEXTI:FO
RI=104TO118:POKE1024+I,R:POKE134
4+I,R:NEXTI:POKE1484,R:POKE1490,
R
2 DATA44,50,105,117,172,178,197,
217,258,264,278,284,325,345,364,
370,425,437
3 FORI=1TO18:READD:POKE992+D,R:P
OKE1023+D,R:POKE1024+D,R:POKE102
5+D,R:POKE1056+D,R:NEXTI
4 PRINT@2,"fractals 1";:PRINT@16
,"by";:PRINT@19,"r.delbourgo";:P
RINT@480,"15,)willowdene av,aust
ralia7005";
7 PLAY"L2003CEG04C03GECP1"
8 POKE65495,0:CLS:PRINT@352," AF
TER THE DRAWING IS FINISHED   YO
U WILL HEAR A SOUND. PRESS    <P
> TO PAINT OUT SURROUNDS OR   <C
> TO CONTINUE.":PRINT@0," ENTER
MULTIPLICATION RATE OF    SPIKES
  (ANY INTEGER BETWEEN    4 AND
16)";:INPUTN:PI=3.14159265
9 IFN<4ORN>16THEN8
10 PMODE4,1:SCREEN1,1:PCLS:M=PI/
N
11 IFN<10THENR=N*7
12 IFN>9ANDN<12THENR=N*5
13 IFN>11THENR=70
15 DIMA(N),U(N)
16 FORI=1TON:A(I)=128+R*COS(M+2*
PI*I/N):U(I)=96+R*SIN(M+2*PI*I/N
):LINE(128,96)-(A(I),U(I)),PSET:
NEXTI
17 R=3.3*R/N:DIMB(N*N),V(N*N)
18 FORI=1TON*N:B(I)=A(1+INT(I-1)
/N)+R*COS(2*PI*I/N):V(I)=U(1+INT
(I-1)/N)+R*SIN(2*PI*I/N):LINE(B(
I),V(I))-(A(1+INT(I-1)/N),U(1+IN
T(I-1)/N)),PSET:NEXTI
19 IFN>10THEN25
```

TO REALIZE THE FULL POWER & PERFORMANCE OF THE 6809, LOOK TO GIMIX.

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#01 (CPU & Software) NEW!	$1698.01

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#12 4 port Parallell (SS50)	$538.12
OS-9 GMXIII drivers . . (included when purchased with GMX III package)	$200.00

OS-9 Level 2 users -- contact GIMIX for system requirements and availability.

192K GMX III #79 SYSTEMS: All include GMX 6809 CPU III and OS-9 GMX III (#01); a #11 3 port Intelligent serial I/O & cables; #19 Classy Chassis; 192KB Static RAM, #68 DMA controller, all necessary cables, power regulators, and filler plates. The OS-9 Editor, Assembler, Debugger, BASIC-09, and RUNB are included.

#79 with dual 40 track DSDD drives	$5998.79
#79 with dual 80 track DSDD drives NEW!	$6298.79
#79 with #88 8'' Dual Drive Disk System	$7598.79
#79 with #90 19MB Winchester subsystem & one 80 track DSDD drive	$8998.79

UniFLEX for the GMX 6809 CPU III and Intelligent I/O boards is in developement.

OS-9 GMX I; OS-9 GMX II; FLEX; and UniFLEX

The **#05** GIMIX 6809 PLUS CPU board			$578.05
Options: GMX DAT	$35.00	SWTPC DAT	$15.00
9511A	$312.00	9512	$265.00

#49 64KB GHOST SYSTEM includes: **#05** CPU; **#19** Classy Chassis; 64KB static RAM; a **#43** 2 port serial card & cables: **#68** DMA Controller; all necessary cables, power regulators, and filler plates; GMXBUG monitor; FLEX; and OS-9 GMX I. You can software select either FLEX or OS-9, The OS-9 Editor, Assembler, Debugger, BASIC-09, and RUNB are also included.

#49 with dual 40 track DSDD drives	$4398.49
#49 with dual 80 track DSDD drives	$4698.49
#49 with #88 8'' Dual Drive Disk System	$5998.49
#49 with #90 19MB Winchester subsystems & one 80 track DSDD drive	$7398.49

#39 128KB SYSTEM includes: **#05** CPUwDAT: **#19** Classy Chassis; 128KB of static RAM; a **#43** 2 port serial card & cables; **#68** DMA Controller; all necessary cables, power regulators, and filler plates; GMXBUG monitor; FLEX; and OS-9 GMX II. You can software select either FLEX or OS-9. The OS-9 Editor, Assembler, Debugger, BASIC-09, and RUNB, and GMX-VDISK for FLEX are included.

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#39 with #90 19MB Winchester subsystem & one 80 track DSDD drive	$7998.39

UniFLEX, available at extra cost, requires 8'' or Winchester drives. A signed license agreement with TSC is required before shipment.

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ALL PRICES ARE F.O.B. CHICAGO

Choose from GIMIX' wide variety of system components.

The **GIMIX CLASSY CHASSIS #19** consists of a heavyweight aluminum cabinet, constant voltage ferro-resonant power supply, and SS50 Mother board with baud rate generator board . . . $1398.19

Triple Disk regulator card and cables	$88.22	Baud rate generator card	$88.93
Missing cycle detector	$38.23	Filler plates	$14.92
Back panel connector plates (specify)	$8.60	*50 Hz. option*	$30.00

MEMORIES (GIMIX uses only Static RAM)

#67 64KB NMOS STATIC RAM board	$478.67
#64 64KB CMOS STATIC RAM board w/battery back-up	$568.64
#34 8K PROM board	$98.34
#32 16 socket PROM/ROM/RAM board	$238.32

I/O Boards (see above for Intelligent I/Os)

#41 Single port serial, RS232/20ma. current loop	$88.41
#43 2 port serial, RS232	$128.43
#46 8 port serial, RS232	$318.46
#42 2 port parallel	$88.42
#45 8 port parallel	$198.45
#50 serial, RS232, RS422, RS423	$244.50
#52 SSDA serial, RS232, RS422, RS423	$254.52
#54 ADLC serial, RS232, RS422, RS423	$268.54
Each cable with connectors for back panel mounting (specify board)	$24.95

DISK CONTROLLERS

#68 DMA (featured in all systems above)	$588.68
#28 dbl. dens. programmed I/O (5'' drives only)	$298.28
#58 single dens. programmed I/O (5'' and/or 8'' drives)	$226.58
#48 same as **#58** but for 5'' drives only	$198.48
Cable sets: 8'' with Back Panel connector	$29.25
for two 8'' external drives	$44.26
for two 5'' drives	$34.96

SOFTWARE: GIMIX exclusive versions of OS-9/GMX I, II, III & FLEX are for GIMIX hardware only. All versions of OS-9 require the **#68** controller.
When ordered with any controller, FLEX is . . . $30.00

GMXBUG PROMs and manual			$98.65
Boot or Video boot PROM	$30.00	UNIFLEX boot PROM	$50.00
OS-9 GMX I	$200.00	OS-9 GMX II	$500.00
Editor	$125.00	Assembler	$125.00
BASIC-09	$200.00	RUNB	$100.00

DISK DRIVES FOR GIMIX SYSTEMS -- complete with cables and power regulators.

5'' DSDD 40 track			2 for $900.00
5'' DSDD 80 track			2 for $1300.00
#88'' Dual 8'' DSDD drives, cabinet, power supply, & cables			$2698.88
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Filler plate	$14.83	Cable for 2 drives	$44.82
Cable for 4 drives	$67.84	Cable for cabinet to mainframe	$45.81

WINCHESTER SUBSYSTEMS: for use only in GIMIX systems with **#68** DMA controller.

#90: includes one 19MB drive, interface, and Software	$3588.95
#91: includes two 19MB drives, interface and Software	$5288.91

Contact GIMIX for price and availability of other forthcoming subsystems.

OTHER BOARDS

#76 GHOST 80X24 VIDEO BOARD			$398.76
#66 50 pin Protoboards	$56.66	**#33** 30 pin Protoboards	$38.33
#03 6800 CPU			$224.03
#06 6800 CPU with timers	$288.06	Baud rate option, add	$30.00

#08 RELAY DRIVER (board, bracket, transformer, and 31 relays)			$1128.08
#86 - #08 (board, bracket, transformer, without relays)			$538.86
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(312) 927-5510 • TWX 910-221-4055

```
20 R=3.3*R/N:DIMC(N*N*N),W(N*N*N
)
21 FORI=1TON*N*N:C(I)=B(1+INT((I
-1)/N))+R*COS(M+2*PI*I/N):W(I)=V
(1+INT((I-1)/N))+R*SIN(M+2*PI*I/
N):LINE(C(I),W(I))-(B(1+INT(I-1)
/N),V(1+INT(I-1)/N)),PSET:NEXTI
22 IFN>5THEN25
23 R=3.3*R/N:DIMD(N*N*N*N):DIMX(
N*N*N*N)
24 FORI=1TON*N*N*N:D(I)=C(1+INT(
(I-1)/N))+R*COS(2*PI*I/N):X(I)=W
(1+INT((I-1)/N))+R*SIN(2*PI*I/N)
:LINE(D(I),X(I))-(C(1+INT(I-1)/N
),W(1+INT(I-1)/N)),PSET:NEXTI
25 SOUND100,1
26 I$=INKEY$:IFI$=""THEN26
27 IFI$="P"THENPAINT(253,96),1,1
:PAINT(3,96),1,1:SCREEN1,0
28 IFI$="C"THENRUN8
29 GOTO26
```

7 0306
20 0609
END ... 078B

Listing 2:

```
1 CLS0:R=127+16*RND(8):FORI=0TO6
:FORJ=0TO480STEP32:POKE1024+I+J,
R:POKE1049+I+J,R:NEXTJ,I:FORI=7T
O24:FORJ=0TO32STEP32:POKE1024+I+
J,R:POKE1472+I+J,R:NEXTJ,I
2 FORI=0TO5:FORJ=0TO32STEP32:POK
E1101+I+J,R:POKE1421+I+J,R:NEXTJ
,I:FORI=0TO1:FORJ=0TO96STEP32:PO
KE1224+I+J,R:POKE1238+I+J,R:NEXT
J,I
3 DATA4,10,16,22,132,150,260,278
,388,394,400,406
4 FORI=1TO12:READD:POKE1024+D,R-
1:POKE1025+D,R-3:POKE1026+D,R-2:
POKE1027+D,R-1:POKE1028+D,R-3:PO
KE1029+D,R-2:POKE1056+D,R-4:POKE
1057+D,R-13:POKE1058+D,128:POKE1
059+D,128:POKE1060+D,R-14:POKE10
61+D,R-8
5 POKE1088+D,R-1:POKE1089+D,R-7:
POKE1090+D,128:POKE1091+D,128:PO
KE1092+D,R-11:POKE1093+D,R-2:POK
E1120+D,R-4:POKE1121+D,R-12:POKE
1122+D,R-8:POKE1123+D,R-4:POKE11
24+D,R-12:POKE1125+D,R-8:NEXTI
6 FORJ=0TO6:FORK=0TO96STEP32:POK
E1095+J+K,128:POKE1107+J+K,128:P
OKE1351+J+K,128:POKE1363+J+K,128
:NEXTK,J
7 PRINT@203,"fractals 2";:PRINT@
239,"by";:PRINT@267,"r.delbourgo
";:PRINT@328,"15,willowdene av";
:PRINT@360,"australia   7005";:
8 PLAY"O3L20CEGO4CO3GECP1":POKE6
5495,0
9 CLS:PRINT@352," WHEN YOU THE F
RACTALS ARE ALL   DRAWN YOU WILL
 HEAR A SOUND.    PRESS <P> TO P
AINT OUT THE      SURROUNDS OR <
C> TO CONTINUE."
10 PRINT@0," ENTER THE NUMBER OF
 SIDES OF     THE FRACTAL POLYGON
 (3 - 8)";:INPUTN:PI=3.14159265
11 IFN>8ORN<3THEN10
12 R=(N+4)*5.6:PMODE4,1:SCREEN1,
1:PCLS
13 DIMA(N),U(N)
14 FORJ=1TON:A(J)=128+R*COS(2*PI
*J/N):U(J)=96+R*SIN(2*PI*J/N):NE
XTJ
15 FORJ=1TON:LINE(A(J),U(J))-(A(
J+1-N*INT(J/N)),U(J+1-N*INT(J/N)
)),PSET:NEXTJ
16 R=3*R/(N+2):DIMB(N*N),V(N*N)
17 FORI=1TON:FORJ=1TON:B(J+(I-1)
*N)=A(I)+R*COS(2*PI*J/N):V(J+(I-
1)*N)=U(I)+R*SIN(2*PI*J/N):NEXTJ
18 FORJ=1TON:K=J+(I-1)*N:LINE(B(
K),V(K))-(B(K+1-N*INT(J/N)),V(K+
1-N*INT(J/N))),PSET:NEXTJ,I
19 R=3*R/(N+2):DIMC(N*N*N),W(N*N
*N)
20 FORI=1TON*N:FORJ=1TON:C(J+(I-
1)*N)=B(I)+R*COS(2*PI*J/N):W(J+(
I-1)*N)=V(I)+R*SIN(2*PI*J/N):NEX
```

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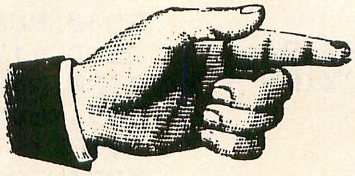

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Amdek Disk Drives	$ Call!	26-1192 CGP-115 Printer	$ 179.00

ACCESSORIES

Hayes SM1200 Modem	$ 599.00	26-1208 CCR-81	$ 52.00
USR AL212 (300/1200)	$ 495.00	26-3008 Joysticks	$ 22.00
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R/S D.C. Modem 2	$ 215.00	Wico Track Ball	$ 59.95
USR AL300	$ 199.00	Wico Joystick	$ 29.00
R/S D.C. Modem 1	$ 129.00	Wico Adapter	$ 19.95
Hayes/USR Cable	$ 19.00	Verbatim Disks	$ 27.95
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SOFTWARE

Telewriter 64	$ 59.95(Disk)	Space Shuttle	$ 28.95 (Cass)
Telewriter 64	$ 49.95(Cass)	Colorpede	$ 29.95 (Cass)
Zaxxon by Sega	$ 34.95(C or D)	Mark Data Adventures	$ 24.95 (Cass)
The King by Tom Mix	$ 26.95(Cass)	Ghost Gobbler	$ 19.95 (Cass)
The Frog by Tom Mix	$ 27.95(Cass)	MSI DATABASE	$ 39.95 (Disk)
Trapfall by Tom Mix	$ 27.95(Cass)	MSI Color Finance	$ 59.95 (Disk)
The Bar Zapper	$ 15.95(Cass)	The Graph Zapper	$ 15.95 (Cass)

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```
TJ
21 FORJ=1TON:K=J+(I-1)*N:LINE(C(
K),W(K))-(C(K+1-N*INT(J/N)),W(K+
1-N*INT(J/N))),PSET:NEXTJ,I
22 IFN>4THEN26
23 R=3*R/(N+2):DIMD(N*N*N*N),X(N
*N*N*N)
24 FORI=1TON*N*N:FORJ=1TON:D(J+(
I-1)*N)=C(I)+R*COS(2*PI*J/N):X(J
+(I-1)*N)=W(I)+R*SIN(2*PI*J/N):N
EXTJ
25 FORJ=1TON:K=J+(I-1)*N:LINE(D(
K),X(K))-(D(K+1-N*INT(J/N)),X(K+
1-N*INT(J/N))),PSET:NEXTJ,I
26 SOUND100,1
27 I$=INKEY$:IFI$=""THEN27
28 IFI$="P"THENPAINT(253,96),1,1
:SCREEN1,0
29 IFI$="C"THENRUN9
30 GOTO27
```

```
8 .......02C1
21 ...... 0680
END ...08EA
```

Listing 3:

```
1 R=RND(8):CLSR:FORJ=0TO11:FORK=
0TO224STEP32:POKE1162+J+K,128:NE
XTK,J:DATA16,132,278,394
2 FORI=1TO4:READD:FORJ=0TO5:FORK
=0TO96STEP32:POKE1024+J+K+D,128:
NEXTK,J,I:DATA13,71,86,129,217,2
60,348,391,406,464
3 FORI=5TO14:READD:FORJ=0TO2:FOR
K=0TO32STEP32:POKE1024+J+K+D,128
:NEXTK,J,I:DATA11,40,55,69,98,18
6,215,258,317,360,389,404,433
4 FORI=15TO27:READD:POKE1024+D,1
22+16*R:POKE1025+D,128:NEXTI:POK
E1152,128:POKE1407,128
5 DATA77,106,121,150,193,252,295
,324,412,441,455,470,499:FORI=28
TO40:READD:POKE1024+D,128:POKE10
25+D,117+16*R:NEXTI
6 PRINT@203,"fractals 3";:PRINT@
239,"by";:PRINT@267,"r.delbourgo
";:PRINT@299,"15,willowdene av";
:PRINT@331,"australia   7005";
7 PLAY"O3L20CEGO4CO3GECP1":POKE6
5495,0
8 CLS:PRINT@352," WHEN THE FRACT
ALS ARE DRAWN A   SOUND WILL BE
HEARD. PRESS <P>  TO PAINT OUT S
URROUNDS OR  <C>  TO CONTINUE."
9 PRINT@0," ENTER THE NUMBER OF
SIDES OF    THE FRACTAL POLYGON
(3 - 8)";:INPUTN:PI=3.14159265:M
=2/N
10 IFN>8ORN<3THEN9
11 R=(N+4)*5:PMODE4,1:SCREEN1,1:
PCLS
12 DIMA(N),U(N)
13 FORJ=1TON:A(J)=128+R*COS(2*PI
*J/N):U(J)=96+R*SIN(2*PI*J/N):NE
XTJ
14 FORJ=1TON:LINE(A(J),U(J))-(A(
J+1-N*INT(J/N)),U(J+1-N*INT(J/N)
)),PSET:NEXTJ:FORJ=1TON:A(J)=A(J
)+M*R*COS(2*(J+1)*PI/N):U(J)=U(J
)+M*R*SIN(2*(J+1)*PI/N):NEXTJ
15 R=M*R:DIMB(N*N),V(N*N)
16 FORI=1TON:FORJ=1TON:B(J+(I-1)
*N)=A(I)+R*COS(2*PI*(J+2)/N+PI):
V(J+(I-1)*N)=U(I)+R*SIN(2*PI*(J+
2)/N+PI):NEXTJ
17 FORJ=1TON:K=J+(I-1)*N:LINE(B(
K),V(K))-(B(K+1-N*INT(J/N)),V(K+
1-N*INT(J/N))),PSET:NEXTJ:FORJ=1
TON:K=J+(I-1)*N:B(K)=B(K)+M*R*CO
S(2*(J+3)*PI/N+PI):V(K)=V(K)+M*R
*SIN(2*(J+3)*PI/N+PI):NEXTJ,I
18 R=M*R:DIMC(N*N*N),W(N*N*N)
19 FORI=1TON*N:FORJ=1TON:C(J+(I-
1)*N)=B(I)+R*COS(2*PI*(J+2)/N+PI
*2/N):W(J+(I-1)*N)=V(I)+R*SIN(2*
PI*(J+2)/N+PI*2/N):NEXTJ
20 FORJ=1TON:K=J+(I-1)*N:LINE(C(
K),W(K))-(C(K+1-N*INT(J/N)),W(K+
1-N*INT(J/N))),PSET:NEXTJ:FORJ=1
TON:K=J+(I-1)*N:C(K)=C(K)+M*R*CO
S(2*(J+4)*PI/N):W(K)=W(K)+M*R*SI
N(2*(J+4)*PI/N):NEXTJ,I
```

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```
21 IFN>4THEN29
22 R=M*R:DIMD(N*N*N*N),X(N*N*N*N
)
23 FORI=1TON*N*N:FORJ=1TON:D(J+(
I-1)*N)=C(I)+R*COS(2*PI*J/N+PI):
X(J+(I-1)*N)=W(I)+R*SIN(2*PI*J/N
+PI):NEXTJ
24 FORJ=1TON:K=J+(I-1)*N:LINE(D(
K),X(K))-(D(K+1-N*INT(J/N)),X(K+
1-N*INT(J/N))),PSET:NEXTJ:FORJ=1
TON:K=J+(I-1)*N:D(K)=D(K)+M*R*CO
S(2*(J-4)*PI/N+PI/N):X(K)=X(K)+M
*R*SIN(2*(J-4)*PI/N+PI/N):NEXTJ,
I
25 IFN>3THEN29
26 R=M*R:DIME(N*N*N*N*N),Y(N*N*N
*N*N)
27 FORI=1TON*N*N*N:FORJ=1TON:E(J
+(I-1)*N)=D(I)+R*COS(2*PI*(J+3)/
N):Y(J+(I-1)*N)=X(I)+R*SIN(2*PI*
(J+3)/N):NEXTJ
28 FORJ=1TON:K=J+(I-1)*N:LINE(E(
K),Y(K))-(E(K+1-N*INT(J/N)),Y(K+
1-N*INT(J/N))),PSET:NEXTJ,I
29 SOUND100,1
30 I$=INKEY$:IFI$=""THEN30
31 IFI$="P"THENPAINT(253,96),1,1
:SCREEN1,0
32 IFI$="C"THENRUN8
33 GOTO30
```

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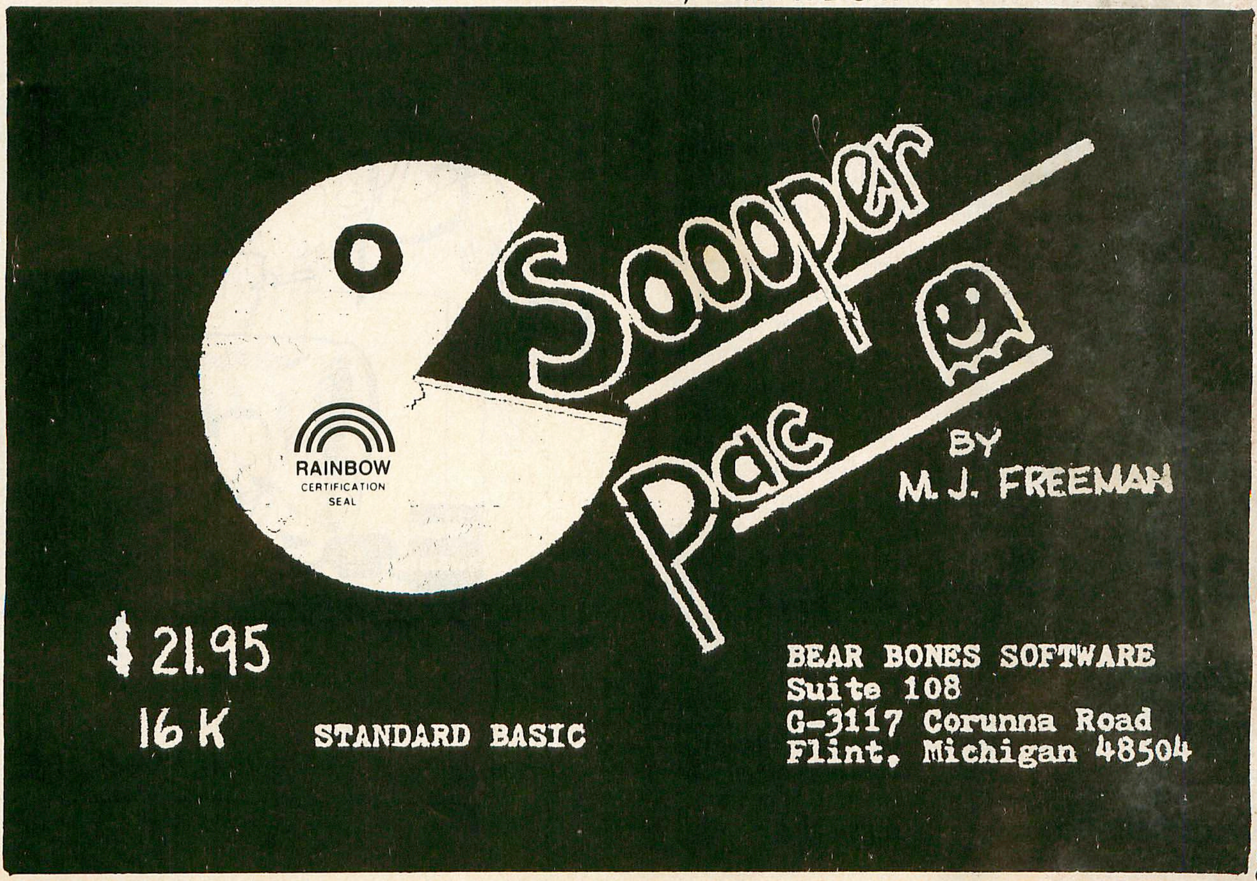

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THE SECRETS OF SUCCESSFUL SOFTWARE SUBMISSIONS

BY TOM NELSON

RAINBOW CONTRIBUTING EDITOR

Independent software authors face a bewildering assortment of problems in trying to present software to the software house for marketing, or should I say, the software industry faces these problems. The problems are latent, and many authors, and perhaps even software houses, are often not aware of them.

The problems arise from the ever-present potential for one person to misappropriate the ideas or programs of another, or for an author to perceive that a software house has stolen the author's programs or ideas. There's always the reality that it is much easier to just steal someone's source code, slightly modify it, and then publish it as a "different" program without giving the author credit than it would be to independently develop the software. It must be said here that any company that did this would not last long in the industry. On the other hand, since software houses are continually developing their own software, misunderstandings can easily arise if a company later markets a piece of software with a similar theme to that submitted by an independent author at some earlier data.

This tremendous potential for actual rip-offs or perceived rip-offs cries for a solution to clarify the relationship which will be entered into between the author and the software house. Both sides have legitimate interests which must be dealt with before any software is sent or received. Honest authors and software houses have no desire or intent to cheat one another, but both sides also have legitimate fears that they may be cheated or subjected to a frivolous lawsuit. To the rescue the software submission agreement.

Software submission agreements are universally used in industries which market products based on "intellectual property" such as software. The underlying purpose of the agreement is to inform the author that submitted software will not be held in confidence, but the author will have all protection afforded by the copyright laws. As an example of one of these agreements I will present here the core language of the software submission agreement used by a well-known company. This agreement is representative of agreements used by many companies.

This submission agreement is in the form of a letter. It is sent in response to inquiries about submitting software, or in response to software submitted without first having inquired in advance about the company's policies. The agreement first indicates that this agreement must form the basis for any submission. It then introduces the company and its policies toward outside submissions, and the need for a submission agreement. The remainder of the agreement is

(Tom Nelson is a Special Assistant Attorney General for the State of Minnesota representing various state agencies, and a consultant to Nelson Software Systems. He has written almost all the manuals for the programs in the Super "Color" Library.)

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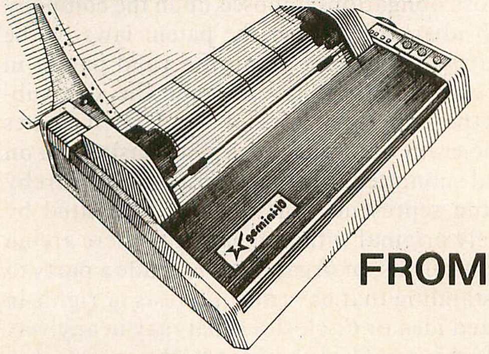

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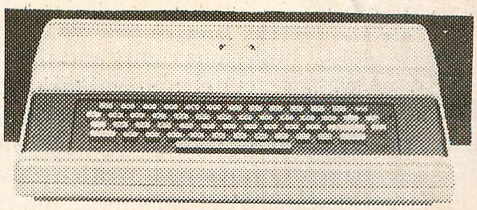

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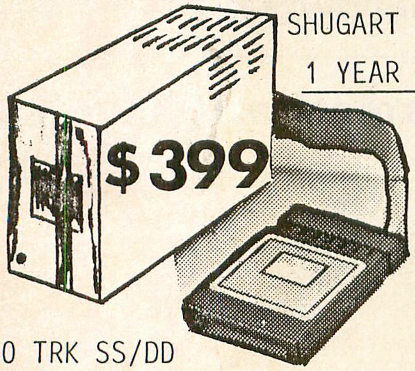
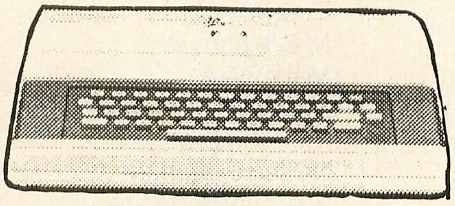
devoted to the terms for submissions. Many companies will discuss royalty arrangements and their general philosophy of marketing software as well. The operative language of the agreement is, of course, the most important. The following terms are exemplary:

> In order to protect both your rights and the rights of the company we will retain your submission in the Legal Department files, and we will consider your submission only upon the following conditions:
>
> 1) All sketches, drawings and written disclosures must be submitted by way of copy only, and the company shall have the right to retain such copies in its files. These copies may not be returned to the submittor.
>
> 2) The company shall have the right to consult others as to the value of and interest in ideas and disclosures submitted to it by the outside person. The company shall only consult others when, in its sole judgment, it deems it necessary and desirable for all parties involved. The company shall not be placed under any obligation whatever to the submittor as a result of having consulted or disclosed submitted ideas to others in an attempt to evaluate the idea and disclosures, and to determine the commercial interest in such ideas.
>
> 3) If the company should decide not to adopt an idea or disclosure, it is understood that the company is not required to divulge any reason for not adopting the idea or disclosure, it being understood that in doing so, the company may be placed in a position of a premature disclosure of its future plans.
>
> 4) It is understood that the submittor shall retain all rights and remedies afforded him by the patent and copyright laws of the United States, and that in no event shall the company have any obligation to the submittor for the unauthorized use or disclosure to others of any disclosure, whether or not patented or the subject matter of copyright or trademark protection, which the submittor may make, except specifically those obligations imposed upon the company and its subsidiaries by either the patent laws of the United States through the grant of a valid patent in which the claims thereof have covered the idea submitted or the copyright laws of the United States through the grant of a valid copyright registration on the material submitted. Further, the submittor hereby warrants and represents that the idea submitted by him is wholly original with him, and that there are no other persons, firms, or organizations made a party to this understanding that have any interests or rights in the submitted idea or disclosures that may in any way affect the company. The submittor further agrees that any subsequent submissions or supplements to the submission made hereinbefore shall be subject to the terms and conditions of this agreement.
>
> 5) The mere receipt of a submitted idea, whether solicited or unsolicited, by the company, and whether relating to a patentable subject matter, copyright, or trademark shall not imply any contractual obligation





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whatever on the part of the company except as to the obligation of the company to evaluate the idea in a manner it deems best and to determine its interest in any valid patent, copyright, or trademark right thereunder.

6) All disclosures, whether solicited or unsolicited, submitted by outsiders and any supplements thereto must be in writing. The officers, agents, and employees of the company may not make any oral commitments of the company with respect to any disclosures. If any statements are made by the officers, agents, or employees of the company to a submittor which the submittor intends to rely upon, the submittor shall submit a record thereof, in writing, immediately to the company. Failure to furnish a supporting statement will have the effect of invalidating any oral conversation.

> *"The problems arise from the ever-present potential for one person to misappropriate the ideas or programs of another, or for an author to perceive that a software house has stolen the author's programs or ideas."*

7) If the subject matter offered to the company is know-how, trade secrets, a proposed trademark, advertising slogan, merchandising plan, business idea, whether or not in use or generally known, or whether or not susceptible to trademark or copyright protection, the company will examine it only under the terms set forth in this agreement.

As you can see, these clauses cover rather completely the potential problems and concerns relating to the submission of software. The first clause gives the company the right to retain submitted copies. This is to protect the company against any future claims by giving it evidence of exactly what was submitted. The second clause gives the company the right to consult with experts and people outside of the company to determine the marketability of the submission. This allows the company to fairly and completely assess the value of the submission before it risks the substantial capital investment which must be made regarding the new product. The third clause makes it clear that the company does not have to give a reason for its rejection of the submission. This is necessary since otherwise it may be forced to announce its future plans, a highly guarded and valuable trade secret. The forth clause provides the limitation on the submittor's remedies. It is a disclaimer of liability for unauthorized disclosure of the submitted idea with express recognition of any rights the submittor may have under copyright or patent law. The clause also contains a statement by the submittor that he or she is the sole owner of the submission. This protects the company against claims of others that the sub-

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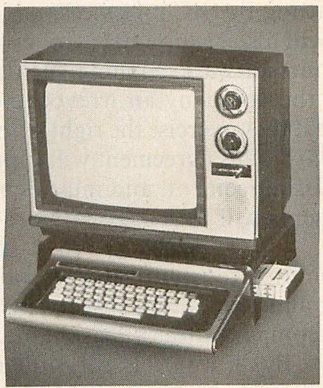

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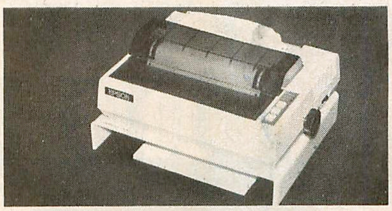

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mittor stole their idea and is trying to sell it. The clause further binds the submittor to the terms of the agreement for any future submissions or supplements. This provision helps avoid excessive paperwork, and recognizes an ongoing relationship.

The fifth clause is important. It makes it clear that the company is only agreeing to review the submission, not to market the submission. The clause helps to avoid misunderstandings. The sixth clause is an attempt to avoid unnecessary disputes arising from any telephone calls or the like. It merely requires that anything to be a part of the final agreement must be in writing, and any oral agreements must be made a part of the agreement or be considered waived. The careful author will be sure to write down the nature of any telephone conversation and compare it with the terms of any future written contract. The final clause reinforces the fact that the submission will be considered only under the terms set out in the agreement.

Okay, now you've seen a sample agreement, so how should you handle your submissions? First, do not just send in your program to a software house without first contacting them. Give them a call in advance. They should be willing to tell you the general terms of any future agreement, and also whether they are even interested in evaluating your program. You can also tell a lot by just bantering with them for a while. You can save a lot of valuable time by finding out in advance whether the company will even consider marketing your program. In fact, I would recommend that you call companies even before you begin developing your program so that you do not spend a lot of time developing a program only to later learn that no one wants it or that it is acceptable only with significant modifications. If you develop a good working relationship early, you can make maximum use of the company's rich marketing experience.

"The underlying purpose of the agreement is to inform the author that submitted software will not be held in confidence, but the author will have all protection afforded by the copyright laws . . . "

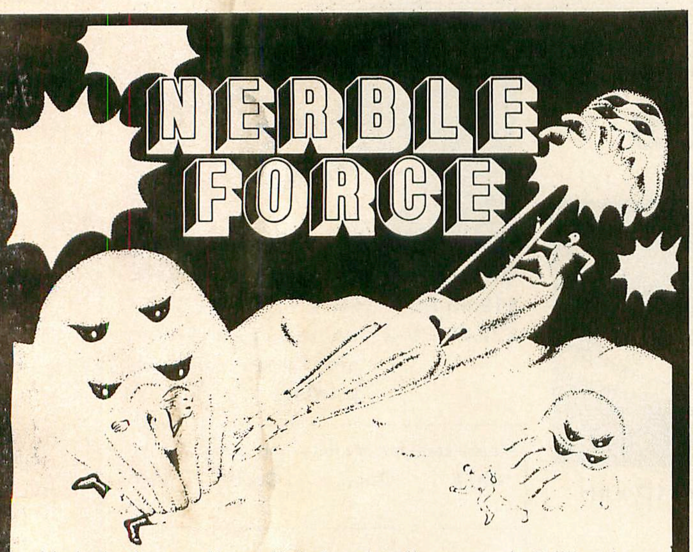
If the company is interested, ask for a copy of their submission agreement, and also feel free to ask to see a sample contract. When you receive the submission agreement, sign it and send it together with your program. Companies differ in the form in which they wish to see your program. I feel it is inadvisable to submit any source code before you have a signed agreement to market your software. Any competent company can evaluate your program from a copy of the object code alone. Of course, this does not apply to those submitting BASIC programs.

Some companies will also require that you give them an option to market your software. Signing such an option agreement will give the company an irrevocable right to market your software if they exercise the right within a given time period, say 30 days. This agreement will supply all the terms of the marketing agreement, and must be read carefully. Option agreements will be discussed more fully in a later column.

Once you have submitted your software, the waiting game begins. If you are not under an option agreement, be sure to check back with the company after a reasonable period of time, say 30 to 60 days. By the way, it is not good practice to submit software simultaneously to more than one company. If either finds out about the other, and they usually ask you, neither will be happy, and probably will reject your program out-of-hand.

With the submission agreement the relationships are clearly set out. Doubt should no longer be present. Now you are ready to advance to the next step of the process of getting your software marketed. Let's assume your program is accepted. Now it's time to get down to contract negotiations. My next column will discuss contract fundamentals to prepare you for the process of negotiating a contract. Until then, good luck with your submissions.

(The information given in this article is not legal advice. If you have legal questions you should see competent legal counsel.)



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Home Money Manager Good Transaction Tracker

Home Money Manager (H.M.M.) is a disk based checkbook program that will keep track of all transactions associated with your checkbook. It is written in BASIC and will run on a 16K system with a printer. *H.M.M.* is a "menu" driven program that will keep track of your checks, deposits, automatic transfers, bank charges, etc. To begin using the program you first create a new check file. The CoCo will ask you for a starting balance and let you name up to 26 accounts. Now you are ready to start entering information from your check register. The CoCo will ask for five pieces of information: check number, date, paid to, amount, and account number. As you enter each transaction, CoCo computes your current balance and displays it on the screen. Data entries are easy to change if you make a mistake.

H.M.M. has one feature I really like. Let's say you purchased three different items (gasoline, clothes, and curtains) last month with a credit card. Now of course you pay this bill with only one check, but if you are trying to run a budget you would want the total amount broken down and charged to three different accounts. *H.M.M.* will allow you to distribute the appropriate amount to each account by re-entering the same check number for each account.

Once you have entered your monthly data, *H.M.M.* will allow you to go back and view any entries you want on the screen. At this point you can delete or edit records as necessary. Two other features probably would not be used often, but nevertheless are useful. The first is the ability to change account names originally specified when creating the file. The other feature allows you to change the current balance. You may need this if, for instance, you transposed numbers when entering a check or deposit, or do not wish to enter bank charges as an expense.

There are four reports available with *H.M.M.* The first is a "transactions report." This report will printout a chronological record of all entries made to the checking account. The second report is a "deposits report." It will print out a chronological record of all deposits made to the checking account. The next report, as you may have guessed by now, is the "expenses report." It will print out a chronological record of all withdrawals made from the checking account. All three of these reports can be printed for the month just completed or for a range of one day to as long as you cover in the file. The fourth report prints out the monthly totals for each of your accounts and also the year-to-date totals.

I found *H.M.M.* to be a user friendly program. The eight pages of documentation are excellently written and you will have a good understanding of how *H.M.M.* works after reading the documentation just once. There is even a demonstration file included with the program to familiarize you with all the features of *H.M.M.* before entering your own data.

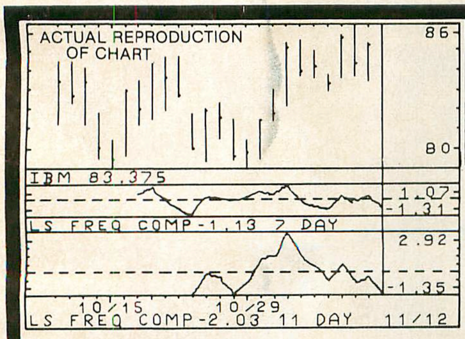
The only thing you may not like about *H.M.M.* is that it's a bit slow. I entered two months data into my file which was about 95 transactions. When I requested a report to be printed, it took two minutes and 40 seconds to sort the checks before starting to print. A full year's data may very well take over 10 minutes to sort. This is a lot faster than any of us could do by hand, but some of you might find it irritating.

With a 16K machine *H.M.M.* will let you record up to 480 transactions. Since the program is written in BASIC, I'm sure it could be modified fairly easily to handle more if you have over 16K.

If you are looking for a program to organize your income and expenses, then I recommend *Home Money Manager.*

(Computerware, Box 668, Encinitas, CA 92024, $19.95)

—Michael Hunt



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Like Word Games? *Scramble's* For You

It's difficult to argue that your typical space games and pac-like thrillers don't challenge the mind, because they often do require concentration and mental alertness. It's probably safe to say that they don't require a lot of intellectual skills.

And after a steady diet of arcade games, it is a welcome change to be challenged by computer programs that test your vocabulary skills. Take *Scramble,* for example, a new creation by Kaleidoscopic Creations of Melrose Park, Ill. It's a word game, which can involve up to four players for hours in creative activity, competition and just plain fun.

The participants, after entering their names, can compete on four levels. The first level allows only words (with 4 to 15 letters) to be entered, and contestants have two and a half minutes to guess the answer. The next level allows words and names, but only two minutes are allotted. The third requires names and titles, with only a minute and a half for answers. The highest level asks for titles and phrases, and there is only one minute.

When a player's turn comes up, his or her name appears on the screen. The opposition types in the word or phrase on the screen and then presses the "/" key, signaling the computers to scramble the terms. (Oh, yes, the player whose turn it is is expected to turn his head while the phrase is being entered.) The phrase takes about five to 10 seconds to be scrambled, which I found a little annoying, but I guess is understandable. If a typing error is committed while entering a word, pressing the "*" key allows you to make corrections.

In order to unscramble the word(s), you must begin with the first position and proceed in order of the word to be spelled. If you type in the wrong letter, a beep sound is emitted by the computer. If there is a space between words, it must be entered or you receive the same signal. This seemed to be a kind of contradiction for me, because phrases appear on the screen as one continuous line of letters, making it very difficult to determine the easier parts of a phrase. All levels of play allow for 10 errors before your turn is over. Bonus points are given for guessing the word(s) before time runs out, but they do not exceed the points awarded for correct unscrambling—which makes you wonder why they are called bonuses.

The game requires only 16K and does not require Extended BASIC. It is written in machine language.

If your experience is like mine, in that you've still not been able to get the female members of the family hooked on the computer, *Scramble* may be the program for which you have been looking. That's assuming, of course, that you do want the ladies to share your time on the CoCo.

(Kaleidoscopic Creations, P.O. Box 1284, Melrose Park, IL 60160, $15.95 tape)

—Charles Springer

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Minidos:

Two Ring Circus for CoCo

*Double your pleasure with **Minidos,** a miniature version of a new virtual disk operating system which will hold two BASIC programs in memory at once.*

By Dr. Laurence D. Preble

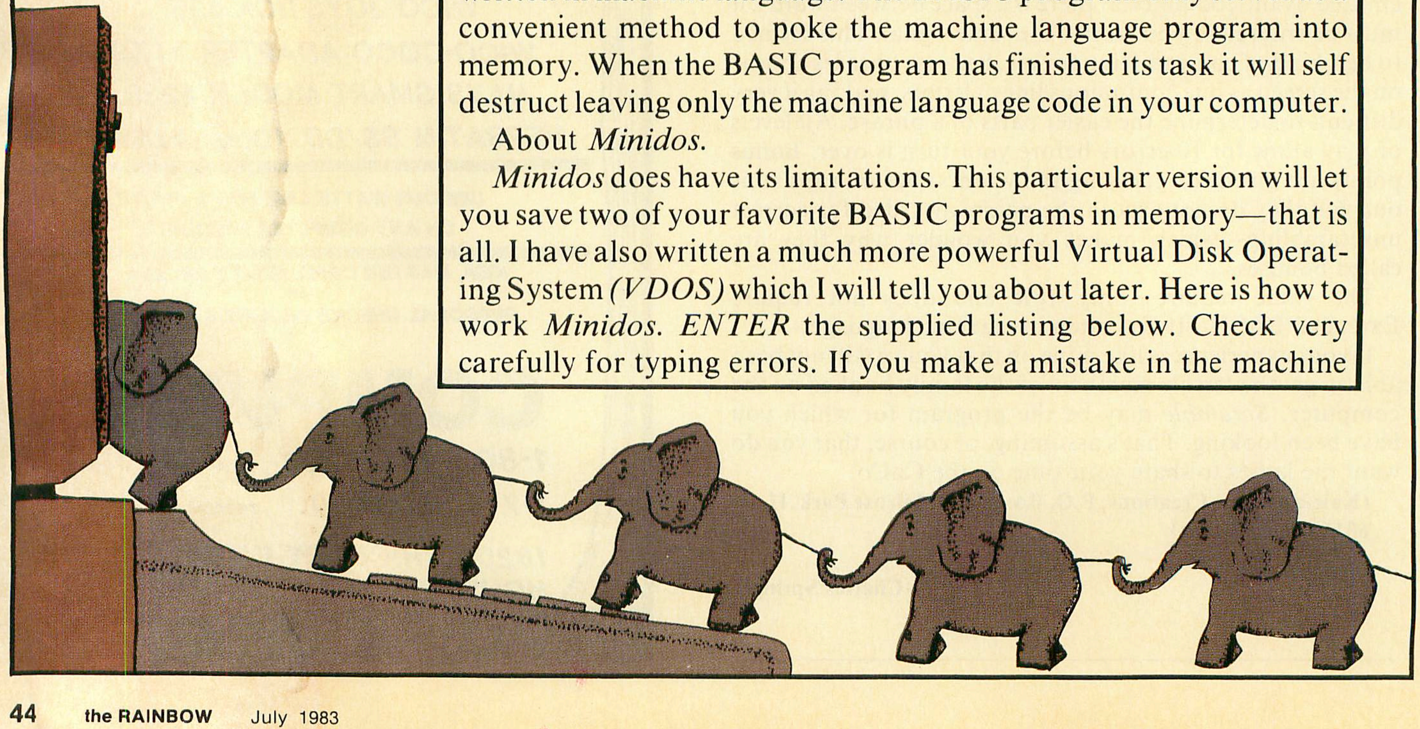
The Color Computer offers several alternatives for saving and loading programs. There is cassette tape which works fine but is very time consuming. For the more fortunate, there is floppy disk which is much faster but quite expensive. Some experimenters have even managed to interface a hard disk to the Color Computer which is extremely fast and extremely expensive. There is one more alternative which is even faster than hard disk but will fit anybody's budget.

It will fit anybody's budget because I am going to give it away to each reader. This final method is memory to memory storage. I will call this method *Minidos* because it acts like a Virtual Disk Operating System. Of course, there is no physical disk involved. *Minidos* is a software technique which is reproduced below.

Do not be fooled by the BASIC program listing. *Minidos* was written in machine language. The BASIC program only serves as a convenient method to poke the machine language program into memory. When the BASIC program has finished its task it will self destruct leaving only the machine language code in your computer.

About *Minidos.*

Minidos does have its limitations. This particular version will let you save two of your favorite BASIC programs in memory—that is all. I have also written a much more powerful Virtual Disk Operating System *(VDOS)* which I will tell you about later. Here is how to work *Minidos. ENTER* the supplied listing below. Check very carefully for typing errors. If you make a mistake in the machine



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STYLOGRAPH™

6809 WORD PROCESSING SYSTEM

AVAILABLE FOR FLEX,™ UniFLEX,™ and OS-9™

The STYLOGRAPH text processing system is a very easy to use but powerful method of creating and printing text. It allows the operator to type text on the CoCo, modifying and correcting it as it's typed, and then print it out. The STYLOGRAPH SYSTEM is cursor-oriented with dynamic screen formating. Cursor based editing means that any portion of the text may be worked on by moving the cursor to that point. Dynamic screen formating means that the text is formated on the screen in the same way it will appear on the printed copy. The display is continuously updated to show how the text will appear. This is a very important feature and is normally available only on very expensive commercial word processing systems. It significantly reduces the time required to produce a finished copy.

FULL FEATURED TEXT EDITING

A full array of commands help in the creation and modification of text. The text displayed on the screen may be moved up, down, left or right. The cursor can be moved to any page or to any specified series of letters or words. The cursor itself can be moved left, right, up, down, to any tab position, or to the extreme left or right. Any block of text can be moved, copied or deleted. The operator may also do a **global replace** so that all occurrences of a given string will be replaced with or without a "prompt" asking if the item should be replaced.

OPERATOR CONVENIENCE

Files longer than memory can be edited. The operator can move forward through a long text file by selectively dumping text to the disk or filling from the disk.

The supervisor mode is **menu driven** and self prompting so that the operator does not have to remember the syntax of commands. This makes it easier for new operators to use the system.

An "assist" or **"help" function** makes it easy to learn the system since it is normally not necessary to consult the manual to learn the commands. This function is menu driven and lists all of the keyboard functions and the formating commands.

At the beginning of the text the operator normally types in a few simple commands indicating the line length, left margin, and so forth, and then enters the header and footer as they should appear. After that the operator need not worry about formating since it is taken care of automatically. Words that extend beyond the end of the line are automatically removed and placed on the next line. **Headers** and **footers** are automatically inserted so that the operator always knows what portion of the page is being worked on. **Ghost hyphens** can be entered so that if the word falls at the end of a line, and a ghost hyphen has been inserted, the hyphen will automatically be added.

FLEXIBLE DISPLAY

Lines longer than the screen width are allowed. STYLOGRAPH can scroll right and left on the screen so that tables can be constructed and appear on the screen exactly as they will appear on the print out.

A command allows viewing of the formating commands on the screen. Another command allows the operator to see which characters will be modified at print out by underlining, superscripting or boldface. A page status command shows the current format values and other useful information.

COMPLETE FORMATING CONTROL

The text of individual lines may be centered, left justified, right justified, or right and left justified. **Tabs** can be set or cleared at any point. Spacing of the lines on the page is under complete operator control with end of page, spacing and vertical tab commands.

While entering text, it may be specified that the characters have some kind of modification when they are printed, such as underlining, superscript, boldface, overline, or subscript. These character modifications are done with "control" key strokes. For example, to start underlining characters, simply hold down the "CTRL" key, hit the "U" key and continue entering text. To stop underlining, hit the "DEL" or "RUB" key.

POWERFUL PRINTING OPTIONS

Underlining is supported on TTY type printers. For those people who have specialty printers there are a variety of additional capabilities including:

1.5 line spacing
BOLDFACE
superscript^1
subscript$_2$
underline, overline,
or any combination

Right and left justification of text is accomplished by incremental printing on TTY type printers. True proportional spacing is supported on the specialty printers.

Control codes may be embedded in the text for special applications. For example, some printers require special control sequences for double width, graphics or boldface. These sequences may be embedded in the text for those users that have these printers. In conjunction with this, it is possible to cause the printer to stop in the middle of a print out for changing printwheels. A backspace feature allows overstriking.

OPERATING SYSTEM COMPATIBILITY

STYLOGRAPH is compatible with the FLEX, UniFlex, and OS-9 disk operating systems. Text files prepared using STYLOGRAPH are directly usable by other software such as BASIC and the assembler. (This significantly aids software development since cursor-based editing allows full viewing of the text being worked on, thereby reducing errors and decreasing programming time). File size is limited only by the capacity of the disk system. Files may be loaded into the text at any point making it possible to rapidly create "boiler plate" documents using portions of text that have been previously saved to a text file. Any portion of a text may be saved to a text file for use at a later point. The printer output may be directed to a disk file for later print spooling. Most operating system commands are directly accessible without leaving STYLOGRAPH.

FULLY ADAPTABLE TO MOST PRINTERS

STYLOGRAPH is easily configured by the user for most terminals so there is no need to send for updates as equipment changes are made. Source code of the terminal interface is supplied so that users with unusual equipment configurations may adapt it to their systems. The source code for all of the "prompts" is also supplied so that foreign language versions may be easily constructed.

Printers currently included as standard are: Diablo, Qume, Starwriter, NEC 5515/25, NEC 5510/20; CENTRONICS 737/739; TTY type printer with backspace function; TTY type printer without backspace function.

COMPLETE INSTRUCTIONS

A special tutorial section is included in the manual so that people with little or no computer experience can easily learn to use STYLOGRAPH in a few hours. A text file is included which demonstrates most of the features of STYLOGRAPH and allows the operator to practice most of the functions. The logical arrangement of the commands and the immediate display of the results greatly simplifies the learning process. In addition there is an "assistance" command which helps the new operator learn the commands.

STYLOGRAPH MAIL MERGE

A major option of STYLOGRAPH is the related MAIL MERGE program. This program adds "form letter" capability to STYLOGRAPH. Variables such as names addresses, dates, may be taken from a disk file or the keyboard at print out time and inserted into the text. Successive letters may be printed out without operator intervention.

The second important capability of the MAIL MERGE program allows many STYLOGRAPH text files to be appended at print out time. This allows files to be edited in smaller, more convenient blocks and then appended at print out time so that the page numbers will remain consecutive and the headers and footers will automatically be retained through all of the print out.

STYLOGRAPH SPELLING CHECKER

Another major option of STYLOGRAPH is the related SPELLING CHECKER program. This program reads through a text file and compares the words in the file with a dictionary. Words that are not found in the dictionary may be marked in the text for later editing, corrected on the spot, skipped, or added to the dictionary. Words may be added to or deleted from the dictionary to create unique vocabularies for particular applications.

STYLOGRAPH for the Color Computer FLEX	**195.00**
STYLOGRAPH MAIL MERGE	**125.00**
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language listing, the program will bomb without necessarily giving any error message. *CSAVE* the program to cassette *before* running it. *RUN* the program. The BASIC listing disappears and *Minidos* is installed.

Minidos has sectioned your computer memory into two halves. If you have a 32K computer, you may now *CLOAD* in a 16K or less BASIC program. If you have a 16K computer, you may now *CLOAD* in an 8K or less BASIC program. Now *CLOAD* in one of your favorite BASIC programs. *LIST* your program or *RUN* it to make certain it is in memory. When you are satisfied your program is all right, type *EXEC* and press the *ENTER* button. Now try to list your program. It is gone! Don't worry. Your program is alive and well, safely tucked away in high user memory. Type in *EXEC* and *ENTER* again. *LIST* your program. It has returned safely.

Now the acid test. Save your program in high memory by typing *EXEC (ENTER)* once more. Next *CLOAD* in one more of your favorite programs. Check to make certain your program will *RUN*. Finally, type *EXEC (ENTER)* to make your newly entered program switch places with the other program tucked into high memory. Check to make certain the other program still will *RUN*. Great! Each time you type *EXEC*, your two programs will switch places and you may run either of them.

Minidos has some obvious limitations. First, only BASIC programs may be saved with *Minidos*. *Minidos* will not work with any of your machine language programs. Secondly, *Minidos* does not maintain a directory. There is no way for you to tell which program has been saved if you forget! *Minidos* will only save ONE extra program. Even if you have plenty of memory space. Multiple saves are not permitted. Finally, once you've loaded *Minidos*, choose the *PCLEAR* that you want, but do not change it while using the program or you'll have problems.

Minidos has a big brother. I call it *VDOS*. *VDOS* is a complete Virtual Disk Operating System designed for 64K and 32K Color Computers. (By the way, any Color Computer can now be upgraded to 64K for as little as $60. See *Rainbow* ads.) *VDOS* will save as many programs as will fit. *VDOS* will even save machine language programs. *VDOS* has a directory function which displays more information than even the normal Radio Shack Disk system. Implemented functions include, *Directory, Save A Basic Program, Save A Machine Program, Load A Basic Program, Load A Machine Program, Kill A Basic Program* and *Kill A Machine Program*. *VDOS* incorporates itself into your computer by giving you an extra command: You just type *VDOS* to get into *VDOS*. Unlike *Minidos*, it is permissible to change PCLEAR modes as often as you like with *VDOS*. Even pressing reset will not harm *VDOS*.

If you have a 64K computer, it is possible to save from 32K to 50K of programs, depending on where you tell *VDOS* to locate itself. All memory is dynamically allocated and reallocated. I have had as many as 25 short programs saved on *VDOS* at once. In any case, if you like *Minidos* but want more, see our ad in this month's *Rainbow*.

The listing:

320 0288
END . . . 0555

```
10 ' MINIDOS - MINI VIRTUAL DISK
20 ' ALLOWS USER TO CLOAD UP TO
30 ' TWO OTHER BASIC PROGRAMS
40 ' AND SWITCH BACK AND FORTH
50 ' BETWEEN THEM.
60 '
70 ' SEE RAINBOW ADVERTISEMENTS
80 ' FOR A COMPLETE VIRTUAL
90 ' DISK OPERATING SYSTEM
100 ' WHICH ALLOWS MULTIPLE
110 ' BASIC AND MACHINE LANGUAGE
120 ' PROGRAM STORAGE AND EVEN
130 ' MAINTAINS A DIRECTORY.
140 '
150 PCLEAR 1
160 CLS 8
170 PRINT"STANDBY";
180 S1=&H21
190 S2=&H22
200 MX=PEEK(S1)*256+PEEK(S2)-25
210 RG=MX-1536
220 SP=INT(RG/2+1536)
230 CL=SP-1
240 READ CT
250 FOR X=SP TO SP+CT
260 READ PK
270 POKE X,PK
280 NEXT X
290 CLS
300 CLS 3
310 PRINT"ONLY ONE GRAPHICS PAGE
"
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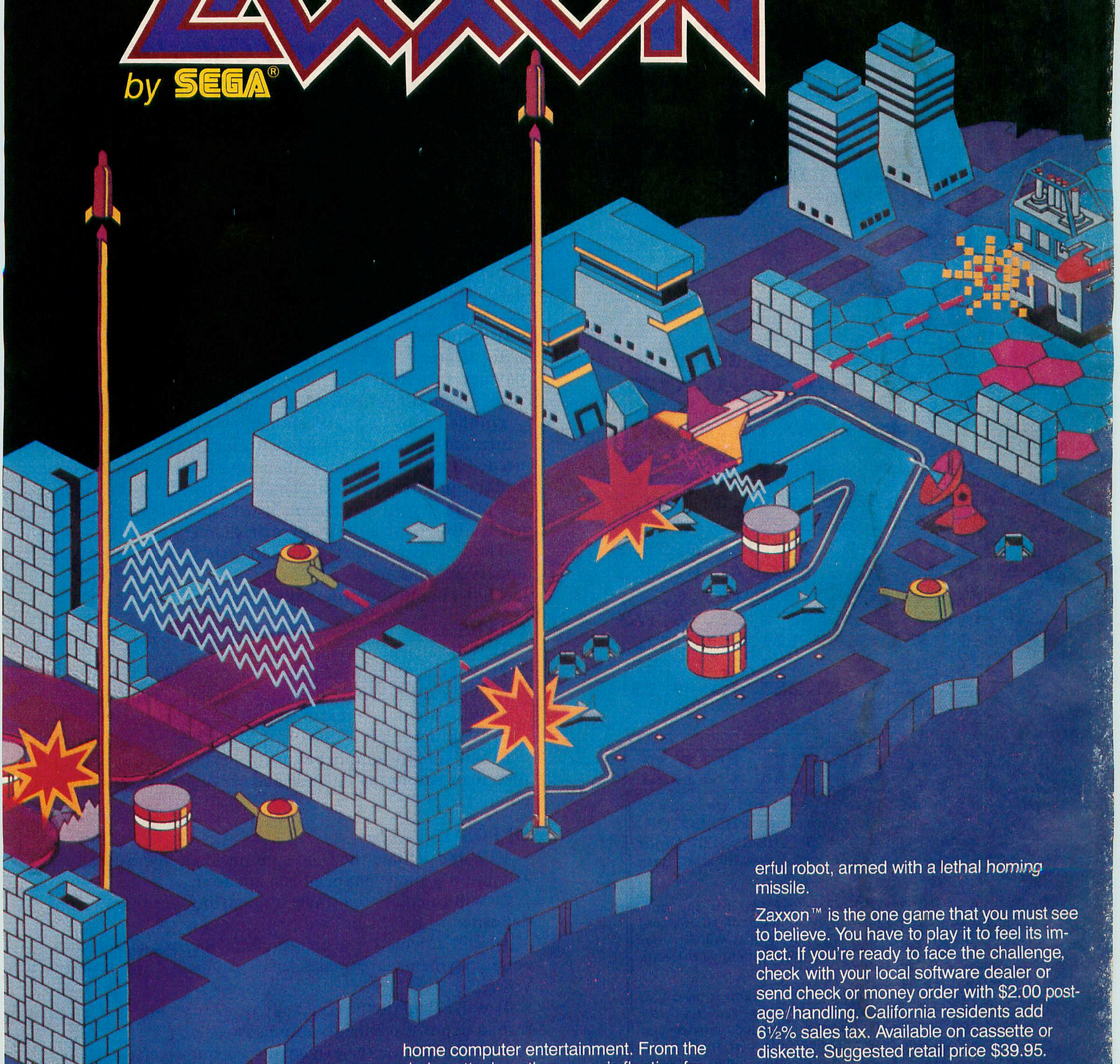

The game that puts space games in perspective. Zaxxon™, one of the most popular arcade games of 1982, is now available for use with your home computer system.

Zaxxon™ technology and creativity present a 3-dimensional-like playfield which sets Zaxxon™ apart from other computer games.

Zaxxon™ looks and sounds like aircraft flight, and players can soar to new levels of home computer entertainment. From the daring attack on the enemy's floating fortress and the blazing battle against the enemy's fighter fleet to the final showdown with the deadly armored robot, Zaxxon™ challenges the skill and imagination of every player at every level of skill.

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Zaxxon™ is the one game that you must see to believe. You have to play it to feel its impact. If you're ready to face the challenge, check with your local software dealer or send check or money order with $2.00 postage/handling. California residents add 6½% sales tax. Available on cassette or diskette. Suggested retail price $39.95.

Available in January on Atari®, February on Apple® and Radio Shack® Color, and April on TI 99/4A™ and NEC 6000™.

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```
320 PRINT"HAS BEEN PCLEAR'D."
330 PRINT:PRINT"REMEMBER TO PCLE
AR MORE"
340 PRINT"IF DESIRED."
350 PRINT:PRINT:FOR X=1 TO 2000:
NEXT X
360 PRINT@480
370 PRINT"TYPE EXEC (ENTER)"
380 PRINT"TO SWITCH BETWEEN PROG
RAMS"
390 PRINT:PRINT:PRINT
400 X1=INT(SP/256)
410 X2=SP-X1*256
420 POKE 157,X1
430 POKE 158,X2
440 CLEAR 200,CL
450 NEW
460 DATA 137
470 DATA 166,141,0,129,38,20,48,
141,0,128,175,141,0,117,111,128,
111,128,108,141,0,111,175,141,0,
103,31,64,147,10,237,141,0,102,1
41,52,174,141,0,91,16,158,25,166
,164,230,132,167,128,231,160,16,
172,141,0,80,37,241,220,27,147,2
5,227,141,0,65,52,6,236
480 DATA 141,0,57,163,141,0,55,2
11,25,221,27,53,6,237,141,0,43,3
2,28,220,27,147,25,237,141,0,38,
236,141,0,29,163,141,0,27,16,163
,141,0,25,35,4,237,141,0,19,57,1
27,2,221,127,2,222,127,2,223,22,
0,0,57,251,255,255,255,0,0,0,251
,251
```

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Home Interest Calculator: Quick, Accurate Assistance

Most families would find B.C. Engineering's *INTRST1, Home Interest Calculator*, quite useful for their software library. It's not a fancy program, no buffer or printout capabilities. You simply input the pertinent information asked for on loans or money deposited in interest-bearing accounts. *Home Interest Calculator*, in turn, calculates the answer quickly and accurately.

It's a great little program for finding the difference in payments for a 20-year home loan as opposed to a 30-year loan. Or, finding the best financing for your next new car.

On the deposit side, it can help plan for Junior's college education or that vacation you dream about. Just input the needed amount of money, the interest rate on the account and the number of years in which to accumulate the money. Or, plan for your retirement. It will calculate the principal needed to receive a desired yearly payment.

The documentation is short and to the point. Quite easy to understand and use.

To the point, the program will do the following:

LOANS

1) Will calculate payment account,
2) Will calculate principal,
3) Will calculate balloon to loan payoff amounts,
4) Will calculate interest rate per period,
5) Will find interest rate charged per compound period,
6) Will find the number of payments that have to be made on a loan before the balance due is below the amount you enter.

DEPOSITS

1) Will calculate the final amount in an interest bearing account if a single payment is made to it,
2) Will calculate the single original amount that must be deposited to get the desired final amount,
3) Will calculate the final amount in an account after equal payments are made to it; payments are assumed yearly,
4) Will calculate the equal payments that can be received from a deposit; payments assumed yearly,
5) Will calculate the principal needed to receive a desired yearly payment,
6) Will calculate the equal payments needed to get the final amount desired; payments assumed yearly.

It may not be as easy to use a TI Business Analyst calculator, but it's somewhat cheaper, and it gives you an excuse to play with your CoCo.

(B.C. Engineering, P.O. Box 768, Manchester, MO 63011, $12.95)

—Pamela Peitsch

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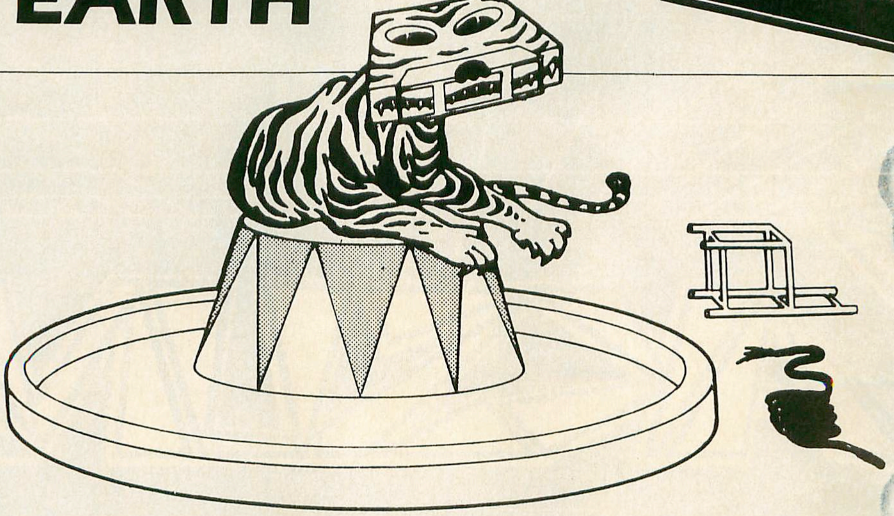

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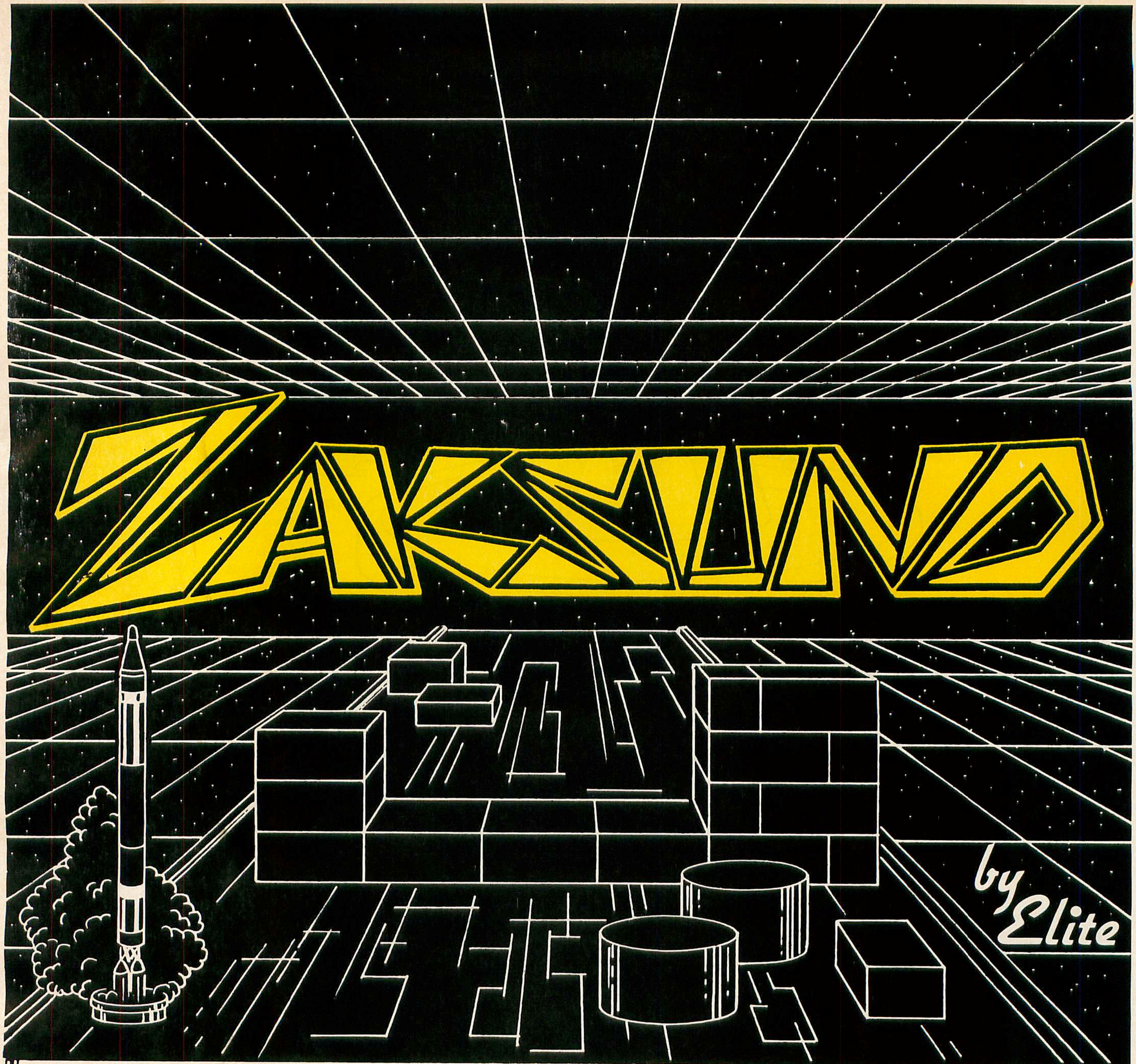

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Here's A 120 Frame 'Graphics Pad' For easy Animation

By Scott L. Bain

Those interested in computer animation would do well to choose the Color Computer. TRS-80C Extended BASIC supports a wide range of extremely user-friendly graphics commands and allows for page switching, making simple, smooth looking animation a relatively easy task. But those who want to create lengthy, animated artwork without resorting to tedious *DRAW* commands and slow graphics updates will need more than eight pages to work with.

Animator is a full function "graphics pad" program that divides each of five graphics pages into 24 miniframes. The user is provided with a cursor controlled drawing board, a window to the area where the individual "frames" are stored, the ability to animate using any or all of the 120 frames, commands to edit and duplicate existing frames, and a subroutine to save finished frames to tape.

Displays

The main display is divided into two smaller displays, outlined by white boxes. The display on the left is the user "pad"—the flashing cursor there is moved using the arrow keys and 1, 2, W, and Q (for diagonals), and wraps around in all four directions. Move (M), Draw (D), Erase (E), Paint, (P), Line (L), Circle, (C), and Box (B) are fully supported in black and white. The display on the right is a window to the current frame position on the storage pages. "F" will advance this position one frame and "R" will move it back one. Pressing the "clear" key will display the storage page currently occupied by the frame cursor (the long white line). There are five storage pages, and repeated use of the "clear" key will allow you to flip through them (see point 5 under "other notes"). "F" and "R" will still work (try them) and "G" will advance the frame cursor one full page.

"#" will clear the user pad. "*" will clear the storage pages and since on powerup the 80C's graphics pages are filled with random "garbage," it is important to clear them first.

Storing and Animating Frames

Using "D," put the cursor into *DRAW* mode, then using the arrow keys and 1, 2, W, and Q draw something on the pad. When you are finished press "S." The right screen (window) should now contain an exact copy of what you just drew, and when you press "clear" you will notice that the storage page has a copy of your figure in the upper left hand corner (this is what the window is "looking at"). Press "F" once—don't hold it down as it will auto repeat—and the frame cursor will advance to the next position. Press the space bar to get back to the main display and you will notice the window is now blank. The window always displays the same frame as the frame cursor is underlining, and vice versa.

Using the pad cursor controls, add something to the drawing you just made (it is still on the pad, you'll note), and press "S" again. This new version of the drawing will be copied into storage at the new frame cursor/window position. Press "clear" and you will see how the two frames are stored.

Press "A" and the two frame animation will begin. Use the "-" key to slow it down and "+" to speed it back up again. Pressing the space bar will stop it completely.

NOTE: *Animator's* "A" command flips through the stored frames, one by one, starting with the first frame and *ending with the frame currently underlined by the frame cursor and displayed in the window*. This means that if you have stored 50 frames but have left the frame cursor on #5, only frames 1 through 5 will be included in the animation procedure. Use "G" and "F" to advance the frame cursor to the last frame position.

Specialty Drawing Commands

Animator's specialty commands make it easy to draw standard figures and erase them. Press "M" to get the pad cursor into "move" mode, and "#" and "*" to clear everything out. Press "'" (shift 7) and a single pixel will be set at the current cursor position, accompanied by a "beep." Move the cursor away, preferably toward a corner. This dot you have left behind is the "endpoint dot" used by the specialty commands. Press "C" and a circle will be drawn using the endpoint dot as the center and the cursor as a point on the circumference. "X," which is just to the left of "C" will erase the circle if you have not moved the cursor. "B" (erased by "V") and "L" (erased by "K") will yield interesting results. Try them. Pressing "'" again will create a new endpoint dot, although the old one will not be erased from the pad.

Paint (P) works just like it does in Extended BASIC, and is mainly intended to be used to fill in closed polygons. "O" does the same thing in black, and therefore can be used as an eraser.

Editing and the "&" Command

Once your animation is finished you may want to change or add to it. This is easily done:

To change an existing frame, merely move the frame cursor/window to the desired position. "T" will transfer (copy) the frame to the pad, wiping out anything that was there. You can now use the pad controls to alter the frame, or you can clear it out and draw something totally new. Either way, "S" will replace the stored frame with whatever is on the pad.

Note that this will completely wipe out the old frame and insert the new in its place.

The "&" command will work exactly the same way except that the pad frame will be added on top of the existing frame, thus combining the two. This can be most useful in complex animations. Programmers should note that the *OR* option of the *PUT* command is at work here.

There is no edit "mode" because (in effect) you are always editing. When creating animation at first, you are actually editing out blank frames and replacing them with filled ones. The commands are always the same.

Command Summary

PAD

D	Puts the cursor into "draw" mode. The cursor will leave a white trail behind it as it moves.
E	Puts the cursor into "erase" mode. The cursor will erase (reset) any pixel it moves through.
M	Puts the cursor into "move" mode. The cursor will move through drawings without disturbing them. NOTE: "." will set a single pixel while in this mode, and "," will reset one.
#	Will clear the pad to black.
shift 7	Will set the endpoint dot.
C	Draws a circle using the endpoint dot as the center and the current cursor position as a point on the circumference. "X" erases it.
B	Draws a box using the endpoint dot and current cursor position as the corners. "V" erases it.
L	Draws a line using the endpoint dot and current cursor position as the endpoints. "K" erases it.
P	Paints the screen white, stopping at white borders. "O" does the same thing in black. (The arrow keys and 1 2 W Q control the movement of the cursor. They will auto repeat, and wrap around.)

WINDOW/FRAME CURSOR

F	Moves position one frame forward. Beeps when last frame reached.
R	Moves position one frame back.
G	Moves position one full page forward, *wraps* around page 5 to 1.
N	Returns position to frame #1, page #1.
clear	Display current page.
space	Return to main display.
*****	Clear all storage.

TRANSFER/EDIT

S	Save pad frame to current storage position.
T	Transfer frame at current position to pad for editing, etc. ("S" returns frame to storage)
&	As "S," but with *OR* option. Adds the pad frame to whatever is stored at the current position.
@	Locks the "F" command on. Every time the "S" key is pressed thereafter, the pad frame will be stored and the frame position automatically advanced as if "F" had subsequently been pressed. A beep will sound each time, reminding you that the lock is still on. Pressing "@" again will turn the lock off.

ANIMATING

A	Animate from frame #1, page #1, up to and including the frame displayed in the window (and underlined by the frame cursor).
space	Stop animating.
-	Slow down the animation.
+	Speed up the animation (begins at full speed)

Saving to Tape

Once an animation is finished, make sure the frame cursor is on the last frame you want stored, then press "/." Use the "Save" option to create a machine language file that should be approximately four tape counts per page saved long, under any name you like, up to eight characters in length.

To load a finished animation back into the program, make sure the storage is clear ("*") then press "/." After the file is loaded, note *the frame cursor must be advanced to the last frame of the animation before using the animate "A" command.* Using the "/" option always returns the frame cursor to the #1 frame. If you press "A" while it's still there, you end up looking at a one frame animation!

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Other Notes

1) Don't worry if you need to "break." The program will never clear out the storage unless you tell it to ("*"). Whatever was on the pad will be lost, though, unless you take the *PCLS* out of line 12 before running.

2) Erasing a line using "L" or a box using "V" will also erase the endpoint dot. Don't be fooled—the endpoint is still the same until you change it by pressing "'" (shift 7) again.

3) Copying a frame from one point of the animation to another is simple. Just move the frame position to the desired frame, transfer ("T") it to the pad (it won't be wiped out of storage, just copied onto the pad), then move the frame position to the new location and save ("S") it. You can duplicate any frame any number of times using this method.

4) The number of dots in the upper left hand corner of the main display indicates which page of the frame cursor it's currently on (each page holds 24 frames, remember).

5) Repeated use of the "clear" key will flip you through the pages in rotation. "G" will actually move the frame cursor position through the pages. If you use "clear" to view a page other than the one currently occupied by the frame cursor, then try to move the frame cursor using "F," "R," or "G," the commands will still function, but you will be flipped back to the current page first.

6) Only those commands listed under "Window/ Frame Cursor" in the command summary will function while you are viewing the storage page(s). If you press any other command key you will be returned to the main display before the command is executed. All commands except "-" and "+" may be used while viewing the main display. ("-" and "+" are only used during animation—there's no reason to use them any other time.).

7) The following keys will auto repeat: the arrows, 1, 2, W, Q, F, R, G, +, and -.

8) Black on white drawing is possible by painting ("P") the screen white, then drawing in black using the erase commands. Note that "&" will not work properly using this method.

9) If your computer cannot use the standard processor speed up, you should remove the *POKE 65495,0* from lines 12 and 19 and the *POKE 65494,0* from line 19.

10) After first loading *Animator* from tape you must *PCLEAR 6* before it will *RUN*. I have no idea why, but *RUNning* twice will also work. I believe it's a quirk in the ROM.

11) This program is dedicated to Andrea R. Chartier, without whom this entire project would never have come to be.

(Scott Bain is a free-lance software author and journalist who works out of San Diego. He and his partner, Andrea Chartier, own and operate Scan Software Designs.)

23	039D
40	060F
54	084B
75	0AC9
93	0D18
108	0F49
END	1181

The listing:

```
10 PCLEAR6
11 CLEAR15:DIMM(11,11):DLAY=1:VP
```

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AGE=2:LOCK=0:OX=64:OY=99:X=OX:Y=
OY:PIXEL=0:PDRAW=2:BX=1:BY=1
12 PMODE0,1:PCLS:CLS:SCREEN1,1:L
INE(42,77)-(86,121),PSET,B:LINE(
170,77)-(214,121),PSET,B:GOSUB10
2:POKE65495,0
13 PMODE0,VPAGE:LINE(BX,BY+42)-(
BX+40,BY+42),PSET:PMODE 0,1
14 FORI=2TOVPAGE
15 PSET(I*4,10,5):NEXTI
16 A$=INKEY$:PSET(X,Y,5)
17 FORT=1TO5:NEXTT:PRESET(X,Y)
18 IFA$="D"THEN PDRAW=1:PSET(X,Y
,5):GOTO14
19 IFA$="/"THENPOKE65494,0:GOSUB
114:GOSUB102:RUN
20 IFA$="B"THEN LINE(OX,OY)-(X,Y
),PSET,B:PSET(X,Y,5):PIXEL=1
21 IFA$="V"THENLINE(OX,OY)-(X,Y)
,PRESET,B:PRESET(X,Y):PIXEL=0
22 IFA$="N"THEN PMODE 0,VPAGE:LI
NE(BX,BY+42)-(BX+40,BY+42),PRESE
T:PMODE 0,1:LINE(1,10)-(40,10),P
RESET:BX=1:BY=1:VPAGE=2:GOSUB 10
2: GOTO 14
23 IFA$<>"@"THEN25
24 IFLOCK=1THENLOCK=0:SOUND100,2
:ELSELOCK=1:SOUND100,2
```

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```
25 IFA$="E"THENPDRAW=0:PRESET(X,
Y):A$=","
26 IFA$="L"THENLINE(OX,OY)-(X,Y)
,PSET:PSET(X,Y,5):PIXEL=1
27 IFA$="K"THENLINE(OX,OY)-(X,Y)
,PRESET:PRESET(X,Y):PIXEL=0
28 IF A$="'"THEN SOUND 200,1:OX=
X:OY=Y:A$="."
29 IFA$="."THENPSET(X,Y,5):PIXEL
=1:GOTO 14
30 IFA$=","THENPRESET(X,Y):PIXEL
=0:GOTO 14
31 IFA$="M"THENPDRAW=2:GOTO14
32 IFA$="S"THENGOSUB68:IFLOCK=1T
HEN A$="F":SOUND100,2:ELSEGOTO14
33 IFA$="&"THENGOSUB68:IFLOCK=1T
HEN A$="F":SOUND100,2:ELSEGOTO14
34 IFA$="A"THENGOSUB74:GOTO16
35 IFA$="#"THENPIXEL=0:GOTO12
36 IFA$="*"THENGOSUB86:GOTO13
37 IF A$="T"THEN GET(172,79)-(21
2,119),M,G:PUT(44,79)-(84,119),M
,PSET:IFPPOINT(X,Y)=0THEN PIXEL=
0 ELSE PIXEL=1
38 IFA$=CHR$(12)THEN GOSUB90:GOT
O17
39 IFA$="F" THEN GOSUB98:GOTO14
40 IFA$="R"THEN GOSUB104:GOTO14
41 IFA$="P"THEN PAINT(X,Y),5,5:P
SET(X,Y,5):PIXEL=1
42 IFA$="C"THEN CIRCLE(OX,OY),SQ
R(ABS(X-OX)^2+ABS(Y-OY)^2):PSET(
X,Y,5):PIXEL=1:GOTO 14
43 IFA$="X"THEN CIRCLE(OX,OY),SQ
R(ABS(X-OX)^2+ABS(Y-OY)^2),0:LIN
E(42,77)-(86,121),PSET,B:PRESET(
X,Y):PIXEL=0:GOTO 14
44 IFA$="O"THEN PSET(X,Y,5):PAIN
T(X,Y),0,0:LINE(42,77)-(86,121),
PSET,B:PRESET(X,Y):PIXEL=0:
45 IFA$="G"THEN GOSUB123
46 IFCHR$(94)=A$THEN Y1=Y-2:X1=X
:GOTO55
47 IFCHR$(9)=A$THEN X1=X+2:Y1=Y:
GOTO55
48 IF CHR$(10)=A$ THEN Y1=Y+2:X1
=X:GOTO 55
49 IF CHR$(8)=A$ THEN X1=X-2:Y1=
Y:GOTO 55
50 IF A$="1" THEN X1=X-2:Y1=Y-2:
GOTO 55
51 IFA$="2"THEN X1=X+2:Y1=Y-2:GO
TO55
52 IFA$="W"THEN X1=X+2:Y1=Y+2:GO
TO55
53 IFA$="Q"THEN X1=X-2:Y1=Y+2:GO
TO55
54 GOTO 14
55 IF X1 <44 THEN X1=X1+42
56 IFY1<79THEN Y1=Y1+42
```

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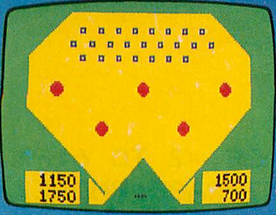

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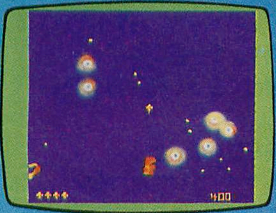

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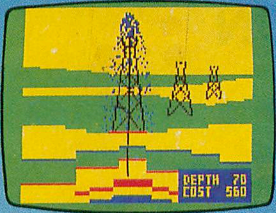

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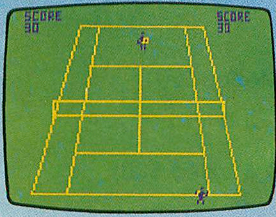

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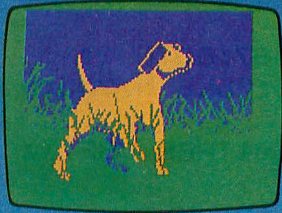

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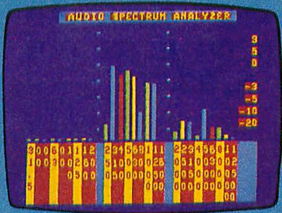

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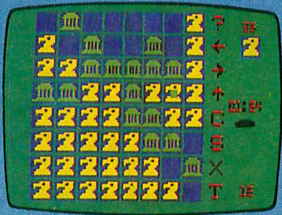

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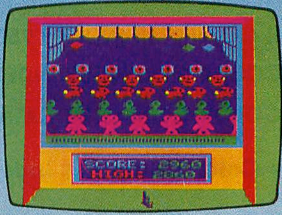

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```
57 IFX1>84THEN X1=X1-42
58 IFY1>119THEN Y1=Y1-42
59 IFPDRAW=1THEN PIXEL=1
60 IF PDRAW=0 THEN PIXEL=0
61 ONPIXEL+1GOTO62,63
62 PRESET(X,Y):GOTO 64
63 PSET(X,Y,5)
64 IF PDRAW=1 THEN PSET(X1,Y1,5)
 ELSE IF PDRAW =0 THEN PRESET(X1
,Y1)
65 IF PPOINT(X1,Y1)<>0 THEN PIXE
L =1 ELSE PIXEL =0
66 X=X1:Y=Y1:GOSUB 67:GOTO 14
67 FOR N=338 TO 345:POKE N,255:N
EXT N:RETURN
68 IFPDRAW=1ORPIXEL=1THEN PSET(X
,Y,5)
69 GET(44,79)-(84,119),M,G
70 PMODE 0,VPAGE
71 IF A$="&" THEN PUT(BX,BY)-(BX
+40,BY+40),M,OR ELSE PUT (BX,BY)
-(BX+40,BY+40),M,PSET
72 PMODE 0,1: IF A$="&" THEN PUT
(172,79)-(212,119),M,OR ELSE PUT
 (172,79)-(212,119),M,PSET
73 RETURN
74 FORPAGE=2TOVPAGE
75 IF PAGE<>VPAGE THEN FOR I=1 T
O 161 STEP 44:FOR J=1 TO 241 STE
P 42:GOTO 78
76 FOR I=1 TO BY STEP 44
77 IF I=BY THEN FOR J=1 TO BX ST
EP 42 ELSE FOR J=1 TO 246 STEP 4
2
78 PMODE 0,PAGE
79 GET(J,I)-(J+40,I+40),M,G:PMOD
E0,1
80 PUT(44,79)-(84,119),M,PSET
81 FORD=1TODLAY:NEXT D
82 A$=INKEY$:IF A$="" THEN 84 EL
SE IF A$="-" OR A$="+" THEN GOSU
B 87:GOTO 84
83 RETURN
84 NEXT J,I,PAGE
85 GOTO74
86 BX=1:BY=1:FOR PAGE =2 TO 6:PM
ODE 0,PAGE:PCLS:NEXT PAGE:PMODE0
,1:LINE(1,10)-(40,10),PRESET:LIN
E(173,79)-(212,118),PRESET,BF:VP
AGE=2:RETURN
87 IF A$="+" THEN DLAY=DLAY-10:I
F DLAY<1 THEN DLAY=1
88 IF A$="-" THEN DLAY=DLAY+10:I
F DLAY>190 THEN DLAY=190
89 SOUND200-D,1:GOSUB67:RETURN
90 CPAGE=VPAGE
91 PMODE0,CPAGE:SCREEN1,1
92 A$=INKEY$:IF A$="" THEN 92
93 IF A$=CHR$(12) THEN CPAGE=CPA
GE+1:IF CPAGE=7 THEN CPAGE=2:GOT
```

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```
0 91 ELSE GOTO 91
94 IF A$="G" THEN GOSUB 123:GOTO
90
95 IF A$="F" THEN GOSUB 98:GOTO
90
96 IF A$="R" THEN GOSUB 104:GOTO
 90
97 PMODE0,1:SCREEN1,1:RETURN
98 PMODE0,VPAGE:LINE(BX,BY+42)-(
BX+40,BY+42),PRESET:PMODE0,1
99 BX=BX+42:IFBX<241 THEN 102
100 IFBY+44>161 AND VPAGE=6 THEN
 SOUND200,10:BX=BX-42:GOTO102
101 IF BY+44>161 THEN VPAGE=VPAG
E+1:BX=1:BY=1 ELSE BY=BY+44:BX=1
102 PMODE 0,VPAGE: GET (BX,BY)-(
BX+40,BY+40),M,G:LINE(BX,BY+42)-
(BX+40,BY+42),PSET:PMODE 0,1:PUT
(172,79)-(212,119),M,PSET
103 GOSUB 67:RETURN
104 IF BX<>1 OR BY<>1 THEN 108
105 IF VPAGE=2 THEN RETURN
106 PMODE 0,VPAGE:LINE(BX,BY+42)
-(BX+40,BY+42),PRESET
107 PMODE 0,1:PRESET(VPAGE*4,10)
:VPAGE=VPAGE-1:BX=211:BY=133:PMO
DE 0,VPAGE:GOTO 112
108 PMODE0,VPAGE
109 LINE(BX,BY+42)-(BX+40,BY+42)
,PRESET
110 BX=BX-42:IFBX>=1 THEN 112
111 BX=211:BY=BY-44
112 LINE(BX,BY+42)-(BX+40,BY+42)
,PSET
113 GET(BX,BY)-(BX+40,BY+40),M,G
:PMODE 0,1:PUT(172,79)-(212,119)
,M,PSET:GOSUB67:RETURN
114 CLS:INPUT"SAVE OR LOAD";T$:T
$=LEFT$(T$,1):IFT$=""THEN122
115 CLS:INPUT"FILE NAME";F$:IFLE
N(F$)>8 THEN 115
116 PRINT"READY TAPE AND HIT 'EN
TER'":LINEINPUTA$
117 PMODE 0,2:SCREEN 1,1
118 IF T$="S" THEN 120
119 CLOADM F$:GOTO 122
120 PMODE 0,VPAGE:LINE (BX,BY+42
)-(BX+40,BY+42),PRESET:PMODE 0,2
121 CSAVEM F$,3072,1535+(VPAGE*1
536),44553
122 PMODE 0,1:SCREEN 1,1:RETURN
123 PMODE0,VPAGE:LINE(BX,BY+42)-
(BX+40,BY+42),PRESET:VPAGE=VPAGE
+1:IFVPAGE>6 THEN VPAGE=2:PMODE0
,1:LINE(1,10)-(40,10),PRESET
124 GOTO102
```

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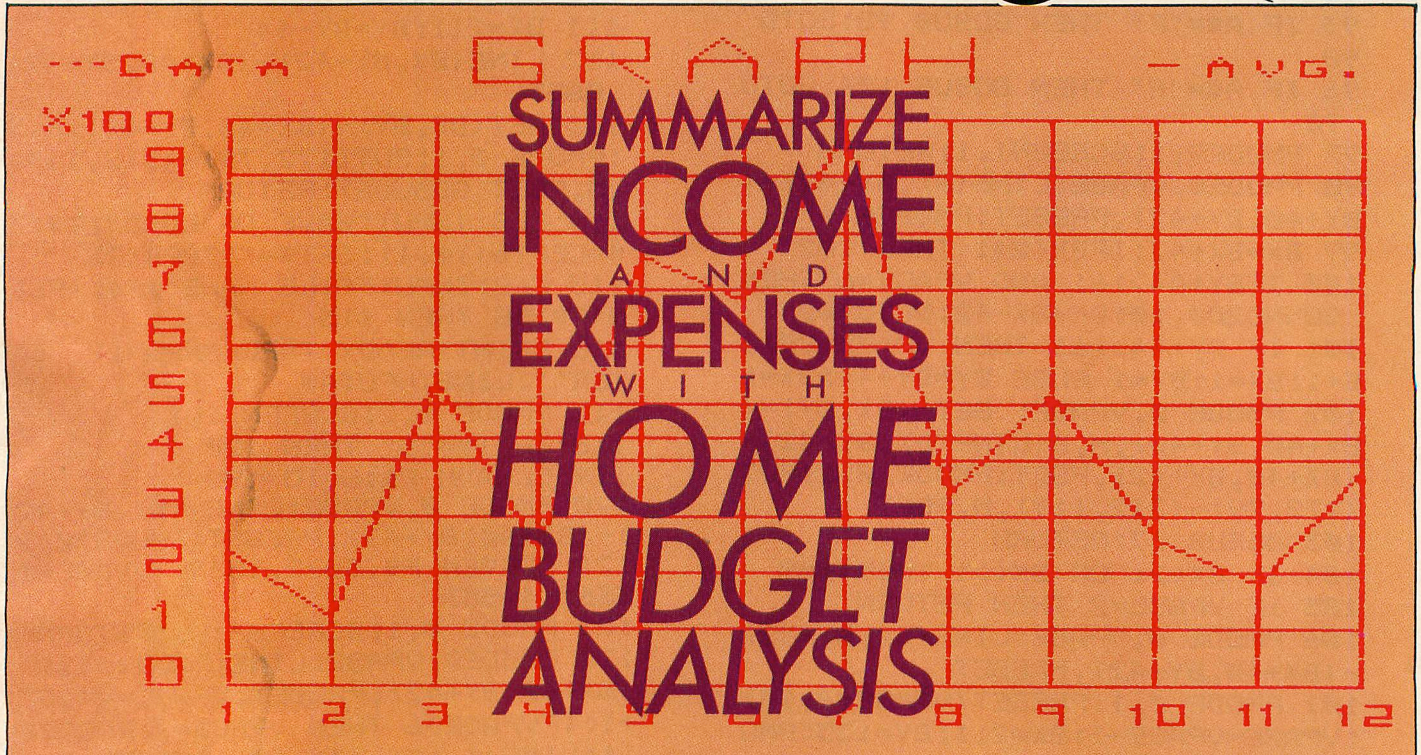

SUMMARIZE INCOME AND EXPENSES WITH HOME BUDGET ANALYSIS

BY J. D. RAY

Home Budget Analysis was developed for my use in summarizing year-end income and expense information for my household budget. This is the kind of program I like to use with my Color Computer because it demonstrates its extreme versatility. In the process of closing out our household finances for 1982, I wanted to be able to compare more visually certain categories and see how much was spent on a month-by-month basis. I use the *Personal Finance* program ROM pak developed by Tandy and its biggest flaw is not being able to print out data with a printer and demonstrate visually what is happening in the various categories.

This program fills that void by allowing you to enter the compiled information from the *Personal Finance* program and send the information to a printer. Then you have the option to see this data displayed on a high-resolution graph. The program not only gives you a month-by-month summary, but a year-end total and an average for the year. Please note that you do not have to use the *Personal Finance* program to compile information. Any process you use to compile your home finances can be used to determine data for this program.

The best part of all of this is the program's ability to graph the information on a high-resolution graph. The grid is drawn with line statements and labeled with alpha-numerics. Then

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the data is plotted. Not only are monthly figures shown, lid blue line indicates the yearly average. Then, after you have gone but a soto all the trouble to compile and enter your data, you can send it to a printer for a permanent record. Please note that the printer subroutine (lines 1495-1640) is optional and can be deleted. The printer I use is the marvelous DMP-200 sold by Tandy and the CHR$ codes used are labeled so you can adapt to your own printer.

The high-resolution graph is actually one graph with three available measuring grids. When you compile your information, you will need to decide which range you will want to visualize. This is important because, as you will discover, the larger range you use, the more difficult it is to compare small amounts and small differences of the monthly figures. For example, if you are comparing figures that are less than $500, to plot these figures on the 0-$10,000 grid would be of little use. However, put these figures on the 0-$1,000 grid or the $400 to $600 grid and you really have something that you can use.

The Program Summary

10— 120	Program Credits
130— 180	Data Statement, Read Line
185— 290	Menu Loop
295— 350	Range of Graph Selection
355— 440	Data Input Loop for Range #2
445— 630	Data Display
635— 650	Line-Plot Formula
655—1020	General Graph Plot—Grid
1025—1130	Data Line-Plot
1135—1290	Average Line-Plot
1295—1310	Line Plot Formula for Range #1 & 3
1315—1380	Data Input Loop for Range #1 & 3
1385—1490	Graph Plot Change for Range #3
1495—1640	Printer Subroutine
1650—1670	Variable Map

Special Programming Techniques

This program has some interesting programming techniques that I feel are worth mentioning. These hints or suggestions could be useful to any home programmer who has to learn as I do—THE HARD WAY!

Line 120 demonstrates a very easy way to freeze a visual on your TV monitor. The range of the *FOR* statement determines how long your program will stall. It is used here to display the program credits.

Lines 290, 350, 630 and 1280 demonstrate how you can keep a program from crashing when you accidentally hit a wrong key. When using *INPUT* lines, you need to determine what specific responses you want or need. List these with the *IF/THEN* statements and use the *ELSE* line with the reference back to the *INKEY$* line (see 630 and 1280).

Lines 360 and 470 demonstrate how you can center a heading at the top of your screen and by changing the *PRINT* @ figure, you can center your heading anywhere on the screen. I suppose I am too fussy about my displays in that I want everything neat and systematical. Centering those lines can really put polish in your programs.

To Use

Change the items in line 150 to meet your own needs. You need to use ten items (or headings) or leave blank spaces between commas. You could also change line 160 to include the number of headings you want to use. You need to leave "review" as option #10 in the main menu or change line 280. "Review" allows you to return to see previously entered data. IMPORTANT: Once you enter new data in any category, all other data will be lost! The "Review" option can correct a mistaken key being pushed.

If you do not have a printer, you can delete lines 630 and 1495-1640. You also have to delete the second half of line 590. If you delete line 630, change line 620 to: If R$ ="N" then 190 ELSE 600. If you do not have a printer, I would highly recommend you eliminate these lines to prevent the program from hanging up in the event "P" is typed. If you plan to use a printer, the printer codes are listed in the program lines so you can adapt to your own printer. These codes are for the DMP-200.

When you are prompted to select a range for your input data, you will have to select one of the following:

0—$ 1,000 Range -1-
0—$10,000 Range -2-
$400—$600 Range -3-

Once you select a range, if you enter a figure outside of this range, you will be asked to re-enter the figure. Listen for the beep and watch for the new prompt. The purpose for the range figures is for the high-resolution graph. If you do not want to compare dollar figures, change the A$ in line 460 and adjust the *PRINT USING* statements in lines 1570 and 1610. You will also need to adjust lines 310, 320, 330 and 1350 to eliminate the dollar signs.

When entering figures, you cannot use commas to separate thousands or you will get an "entry ignored" error statement. Also, to enter a 0, just press *ENTER* and you will be prompted for the next month.

When the entered data is displayed, you have three options, which are listed on the screen:

Y—to see data on high-resolution graph
N—to return to Menu Listing for other comparisons
(NOTE: All previously entered data will be lost once you begin entering new data. If you press "N" accidentally or choose to review previously entered data, select option #10 listed as "REVIEW" and the old data will be displayed. Use the SHIFT, 0 key to type "review" in reverse letters.)
P—sends list to printer (NOTE: You will be prompted with a "PRINTER READY?" Press *ENTER* to begin the line feed.)

When the high-resolution graph is used, you also have three options ("L" & "R" are listed on screen under the word "GRAPH"):

L—to return to the menu listing (see NOTE above)
R—to return and REVIEW data listing display
N—to END program

In case you are not familiar with alpha-numerics, you need to understand that on graphic screens (PMODE1-4), you cannot use regular type, thus you have to use *DRAW* statements and actually draw the letters and numbers on the high-resolution screen. If you are using a small TV monitor (I use a 19 inch Color TV), the alpha-numerics may distort and be unreadable. If this is the case for you, then you'll need to adjust the *DRAW* lines. The letter or number being drawn is indicated on each *DRAW* line.

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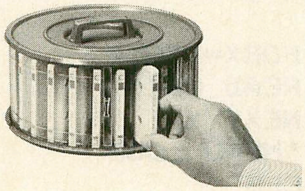

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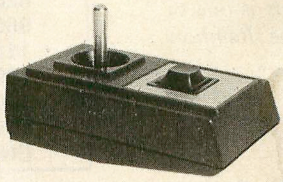

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This program has been a lot of fun to develop and will receive a lot of use in my home and business. This program should be bug-proof, however, if you have any problems, just contact me and I will try to help you. This program is available on tape along with another like it to compare various yearly figures. J. D. Ray, 5065 France Avenue, North Charleston, SC 29406. My phone is 1-803-554-0627.

295	034D
490	05C0
640	0896
820	0A77
980	0CF9
1130	0F12
1290	113C
1400	141C
1560	1632
END	1918

Home Budget Analysis is one of three programs on *the Rainbow* 'Record.' See page 146.

The listing:

```
10 '***HOME BUDGET ANALYSIS***
20 'BY J. D. RAY
30 '    5065 FRANCE AVENUE
40 '    N. CHARLESTON, S.C. 29406
50 '    1-803-554-0637
60 CLS5:PRINT@99,STRING$(26,"%")
;
70 PRINT@131,"%% HOME BUDGET ANA
LYSIS %%";
80 PRINT@163,"%%
      %%";
90 PRINT@195,"%%    BY  J. D. RA
Y      %%";
100 PRINT@227,"%%  COPYRIGHT (C)
 1983  %%";
110 PRINT@259,STRING$(26,"%");
120 FOR T=1 TO 1200:NEXTT
130 DIM T(13)
140 DIM Q$(10)
145 'INSERT YOUR OWN HEADING FOR
 THE MENU LISTING
150 DATA INCOME, ELECTRICAL USE
EXPENSE, TELEPHONE EXPENSE, MEDI
CAL EXPENSE, SAVINGS, CLOTHING E
XPENSE, GROCERY EXPENSE, MISCELL
ANEOUS, AUTOMOBILE EXPENSES,revi
ew
160 FORX=1TO10
170 READ Q$(X)
180 NEXT X
185 'MENU LOOP
190 CLS
200 PRINT@67,"WOULD YOU LIKE TO
COMPARE:"
210 L=130
220 FORX=1TO10
230 PRINT@L,X;Q$(X)
240 L=L+32
250 NEXT X
260 PRINT@460,"(1-10)"
270 INPUT X
280 IF X=10 THEN 460
290 IFX<0 OR X>10 THEN 270
295 'VARIABLE SELECTION
300 CLS:PRINT:PRINT"  ALL FIGURE
S ENTERED MUST BE:
310 PRINT:PRINT"     0 - $ 1,000.
00  RANGE <1>"
320 PRINT"     0 - $10,000.00  RA
NGE <2>"
330 PRINT"     $-400 - $600.00 RA
NGE <3>"
340 PRINT:INPUT "SELECT RANGE: "
;Z
350 IF Z<1 OR Z>3 THEN 340
355 'DATA INPUT LOOP
360 CLS:PRINT@15-INT(LEN(Q$(X))/
2),Q$(X)
370 T$=Q$(X)
380 PRINT
390 IF Z=1 OR Z=3 THEN GOSUB 132
0
395 'DATA INPUT LOOP FOR RANGE#2
400 FOR X=1 TO 12
410 PRINT "# ";X
420 INPUT "MONTH ";T(X)
430 IF T(X)>10000 THEN PRINT "AM
OUNT IS TOO HIGH.            PL
EASE ENTER NUMBER < 10000":SOUND
 150,1:GOTO410
440 NEXT X
445 'DATA DISPLAY
450 M=0
460 L=36:P=48:A$="$$##,###.##"
470 CLS:PRINT @ 15-INT(LEN(T$)/2
),T$
```

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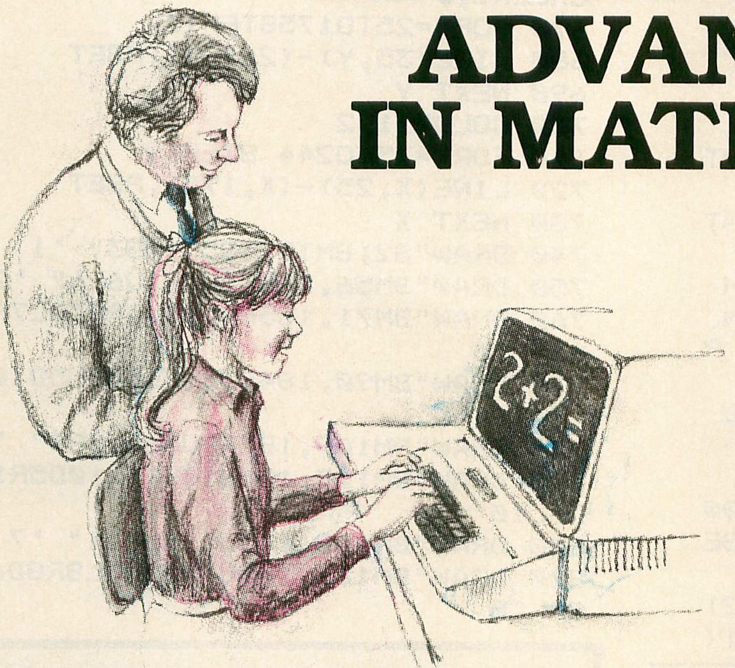

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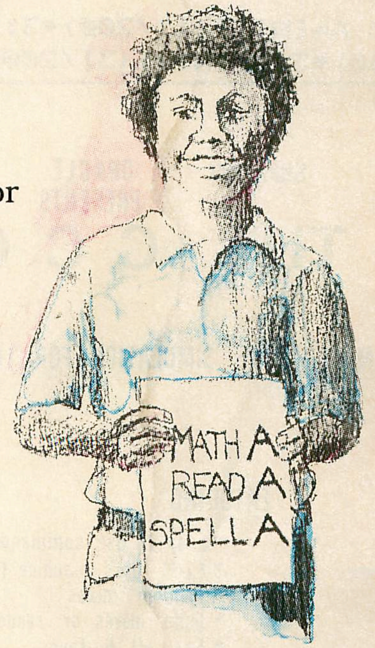

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```
480 FORX=1 TO 12
490 PRINT@L,"MONTH # ";X:PRINT@P
, USING A$;T(X)
500 L=L+32:P=P+32
510 NEXT X
520 T=T(1)+T(2)+T(3)+T(4)+T(5)+T
(6)+T(7)+T(8)+T(9)+T(10)+T(11)+T
(12)
530 PRINT@416,"TOTAL:    ";:PRINT
USINGA$;T
540 T=T/12
550 IF Z=1 THEN M=INT(T/20)*3
560 IF Z=2 THEN M=INT(T/200)*3
570 IF Z=3 THEN M=INT(T/20)*3
580 PRINT@448,"AVERAGE: ";:PRINT
USINGA$;T
590 PRINT@437,"GRAPH? Y/N":PRINT
@469,"PRINT? <P>"
595 'SELECTION- (Y) TO SEE HIGH
RESOLUTION GRAPH; (N) TO RETURN
TO MENU; & (P) TO SEND DATA TO P
RINTER
600 R$=INKEY$:IF R$="" THEN 600
610 IF R$="Y" THEN 640
620 IF R$="N" THEN 190
630 IF R$="P" THEN 1500 ELSE 600
635 'LINE PLOT FORMULA FOR RANGE
#2
640 A=INT(T(1)/200)*3:B=INT(T(2)
/200)*3:C=INT(T(3)/200)*3:D=INT(
T(4)/200)*3:E=INT(T(5)/200)*3:F=
INT(T(6)/200)*3:G=INT(T(7)/200)*
3:H=INT(T(8)/200)*3:I=INT(T(9)/2
00)*3:J=INT(T(10)/200)*3:K=INT(T
(11)/200)*3:L=INT(T(12)/200)*3:
650 IF Z=1 OR Z=3 THEN GOSUB 130
0
655 'GENERAL GRAPH PLOT - GRID
660 CLS:PMODE3,1:COLOR1,2:PCLS:S
CREEN1,0
670 FORY=25TO175STEP15
680 LINE(35,Y)-(244,Y),PSET
690 NEXT Y
700 COLOR 1,2
710 FORX=35TO244 STEP19
720 LINE(X,25)-(X,175),PSET
730 NEXT X
740 DRAW"S2;BM35,185U10G3" '1
750 DRAW"BM56,185L6U5R6U6L6" '2
760 DRAW"BM71,185R8U10L8R8D5L7R7
D5" '3
770 DRAW"BM90,184BU5U5D5R8U5D10"
 '4
780 DRAW"BM109,185R9U6L9U5R9" '5
790 DRAW"BM128,185U10R10L10D5R10
D6L10" '6
800 DRAW"BM148,185U5E6L8D1" '7
810 DRAW"BM166,185U10R8D5L8R8D6L
8" '8
```

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```
820 DRAW"BM189,185U10L8D5R8" '9
830 DRAW"BM203,185U10G3":DRAW"BM
207,185U10R8D10L8" '10
840 DRAW"BM223,185U10G3":DRAW"BM
227,185U10G3" '11
850 DRAW"BM241,185U10G3":DRAW"BM
249,185L8U5R8U6L8" '12
860 IF Z=3 THEN GOTO 1390
870 DRAW"S3;BM20,175U10R10D10L10
" '0
880 DRAW"BM25,160U10G3" '1
890 DRAW"BM26,145L8U4R8U6L8" '2
900 DRAW"BM27,130U10L8R8D4L6R6D6
L8" '3
910 DRAW"BM25,115U11G6R9" '4
920 DRAW"BM20,100R8U6L8U4R8" '5
930 DRAW"BM20,85U10R8L8D5R8D6L8"
 '6
940 DRAW"BM23,70U6E5L7" '7
950 DRAW"BM20,55U10R8D5L8R8D6L8"
 '8
960 DRAW"BM27,40U10L8D5R8" '9
970 DRAW"S2;BM1,28U2E8U2BL8D2F8D
2":DRAW"S2;BM9,28U10G3":DRAW"BM1
2,28U10R8D10L8":DRAW"BM21,28U10R
8D10L8":IF Z=2THENDRAW"BM28,28U1
0R8D10L8" 'X1000
980 DRAW"S5;BM80,15U10R10D2U2L10
D10R10U4L4" 'G
990 DRAW"BM100,15U10R10D5L10R5F5
" 'R
1000 DRAW"BM120,15U5E5F5L10R10D5
" 'A
1010 DRAW"BM140,15U10R10D5L10D5"
 'P
1020 DRAW"BM160,15U10D5R10U5D10"
 'H
1025 'DATA-LINE PLOT
1030 COLOR4,2
1040 V=175
1050 IF Z=3 THEN V=115
1060 LINE(35,V-A)-(54,V-B),PSET:
LINE -(73,V-C),PSET:LINE-(92,V-D
),PSET:LINE-(111,V-E),PSET:LINE-
(130,V-F),PSET:LINE-(149,V-G),PS
ET:LINE-(168,V-H),PSET:LINE-(187
,V-I),PSET:LINE-(206,V-J),PSET:L
INE-(225,V-K),PSET:LINE-(244,V-L
),PSET
1070 LINE (5,10)-(10,10),PSET
1080 DRAW"S2;BM15,13U10R6F4D5G3L
6" 'D
1090 DRAW"BM25,13U5E5F5L10R10D5"
:DRAW "BM41,13U5E5F5L10R10D5" 'A
1100 DRAW"BM35,13U8L5R8" 'T
1110 COLOR 3,2
1120 V=175
1130 IF Z=3 THEN V=115
1135 'AVERAGE-LINE PLOT
1140 LINE (35,V-M)-(244,V-M),PSE
T
1150 LINE(205,10)-(210,10),PSET
1160 DRAW"S2;BM216,13U6E5F5L9R9D
6" 'A
1170 DRAW"BM227,13H5U5D5F5E5U5BD
10" 'V
1180 DRAW"BM233,13U8R8D1U1L8D8R8
U4L3R3D4" 'G
1190 LINE(241,13)-(242,13),PSET:
LINE(241,12)-(242,12),PSET
1200 DRAW"C1;BM110,23H5E5" '<
1210 DRAW"BM119,23U10D10R6" 'L
1220 DRAW"BM133,23U10R9D5L9R3F6"
 'R
1230 DRAW"BM145,23E5H5" '>
1240 DRAW"BM126,20L2" '-
1245 'SELECTION-(L) TO RETURN TO
 MENU LIST; (R) TO REVIEW DATA E
NTERED; & (N) TO END PROGRAM.
1250 R$=INKEY$:IFR$=""THEN1250
1260 IF R$="L" THEN 190
1270 IF R$="R" THEN 460
1280 IF R$="N" THEN END ELSE 125
0
1290 END
1295 'LINE PLOT FORMULA FOR RANG
E# 1 & 3
1300 A=INT(T(1)/20)*3:B=INT(T(2)
/20)*3:C=INT(T(3)/20)*3:D=INT(T(
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```
4)/20)*3:E=INT(T(5)/20)*3:F=INT(
T(6)/20)*3:G=INT(T(7)/20)*3:H=IN
T(T(8)/20)*3:I=INT(T(9)/20)*3:J=
INT(T(10)/20)*3:K=INT(T(11)/20)*
3:L=INT(T(12)/20)*3
1310 RETURN
1315 ' DATA INPUT LOOP FOR RANGE
1 & 3
1320 FOR X=1 TO 12
1330 PRINT "# ";X
1340 INPUT "MONTH ";T(X)
1345 IF Z=1 THEN GOTO 1360
1350 IF Z=3 AND T(X) <-450 OR T(
X) > 600 THEN PRINT"AMOUNT IS OU
T OF RANGE.":PRINT"PLEASE ENTER
NUMBER BETWEEN":PRINT"    $-400.
00 - $600.00":SOUND 150,1:GOTO 1
330
1360 IF Z=1 AND T(X)>1000 THEN P
RINT"AMOUNT IS TOO HIGH.":PRINT"
PLEASE ENTER NUMBER < 1000":SOUN
D 150,1:GOTO 1330
1370 NEXT X
1380 GOTO 460
1385 'GRAPH PLOT CHANGE FOR RANG
E #3
1390 DRAW"S3;BM15,170L3":DRAW"BM
25,175U11G6R9" '-4
1400 DRAW"BM15,155L3":DRAW"BM27,
160U10L8R8D4L6R6D6L8" '-3
1410 DRAW"BM15,140L3":DRAW"BM26,
145L8U4R8U6L8" '-2
1420 DRAW"BM15,125L3":DRAW"BM25,
130U10G3" '-1
1430 DRAW"BM20,115U10R10D10L10"
'0
1440 DRAW"BM25,100U10G3" '1
1450 DRAW"BM26,85L8U4R8U6L8" '2
1460 DRAW"BM27,70U10L8R8D4L6R6D6
L8" '3
1470 DRAW"BM25,55U11G6R9" '4
1480 DRAW"BM20,40R8U6L8U4R8" '5
1490 GOTO 970
1495 'PRINTER SUB-ROUTINE
1500 PRINT @ 437,"PRINTER":PRINT
 @ 469,"READY?":SOUND 160,2
1510 R$=INKEY$:IF R$="" THEN 151
0:IF R$=" " THEN GOTO 1520
1520 PRINT#-2,CHR$(27);CHR$(19)
'SELECT STANDARD CHARACTER
1530 PRINT#-2,CHR$(15) 'START UN
DERLINE
1540 PRINT#-2,T$
1550 PRINT#-2,CHR$(14) 'END UNDE
RLINE
1560 FOR X=1 TO 12
1570 PRINT #-2,USING"##.";X;:PRI
NT#-2,USING"$$##,###.##";T(X)
1580 NEXT X
1590 PRINT#-2,CHR$(10) ' LINE FE
ED
1600 T=T(1)+T(2)+T(3)+T(4)+T(5)+
T(6)+T(7)+T(8)+T(9)+T(10)+T(11)+
T(12)
1610 PRINT#-2,"TOTAL:     ";:PRINT
 #-2,USING"$$##,###.##";T
1620 T=T/12
1630 PRINT#-2, "AVERAGE: ";:PRIN
T #-2,USING"$$##,###.##";T
1640 GOTO 590
1650 'VARIABLE MAP:
1651 'T(X) - INPUT DATA FOR MONT
HS OF YEAR OR 12 PERIODS OF TIME
1652 'Q$(X) - MENU SELECTION
1653 ' Z - RANGE OF INPUT DATA
1654 ' T$- HEADINGS FROM MENU
1655 ' T - TOTAL OF T(X)'S AND A
VERAGE
1656 ' M - VARIABLE FOR AVERAGE
LINE PLOT
1657 ' A-L - VARIABLES FOR THE 1
2 MONTHS OR TWELVE PERIODS
1658 ' R$ - SELECTION STRING:
1659 ' Y - YES
1660 ' N - NO (END)
1661 ' P - PRINTER
1662 ' L - RETURN TO MENU LIST
1663 ' R - REVIEW
1670 'MEMORY AVAILABLE - 2107
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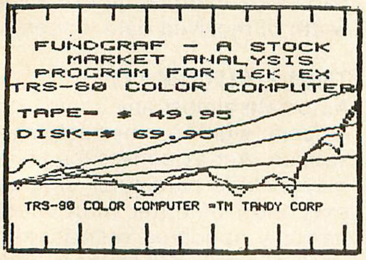
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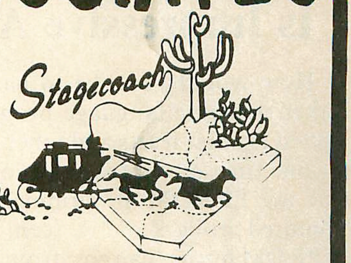

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Sherlock Holmes/Agatha Christie fans-It's finally here—A murder mystery game for the 80-C! Mr. Goodbody has been killed in his mansion and you must solve the mystery. WHO committed the murder, WHERE did it occur and HOW was it done! Question suspects, find the secret passage, and break the code to get clues. Hi-Res graphics enhances this excellent game. The computer records the clues you obtain on a clue inventory screen and also provides suspect descriptions at the touch of a finger. A fast, fun game that will sharpen your deductive skills. Every game is different!

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Save hours of tedious work with this efficient program. Calculates individual player average, high game and total pins, as well as team games won/lost, high series, and cumulative total team pins. Also calculates team standings for each week in order from 1st to last! All data stores to tape and outputs to printer to provide professional, easy to read copy. After initial input of league and player names all you have to do is input each week's scores - the computer does the rest!!

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Astrology Chart Print

A Must for the Serious Astrologer

Bothered by not having a professional easy to read hard copy of your chart? Want to see comparison charts around the Natal Chart? Look no more! Input of planetary positions and house cusps outputs a 6"x5" graphic printout of chart and will also plot a comparison chart (transit, progressed or compatibility) around perimeter of the natal chart. NOT A SCREEN DUMP ROUTINE. The program uses dot addressable graphics to draw chart with accurate planetary positioning. Top of form lists Name, Birthdate, Birthtime, Birthplace from user input. Accomodates Placidean, Equal House or Modified Equal House. AVAILABLE NOW FOR EPSON MX80 with Graftrax.

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16KEXT Cassette $19.95

Software Review

New EPROM Programmer Is Impressive And Affordable

How would you like to have your favorite monitor or other machine language programs on instant recall, protected against resets and other inevitable bombouts? I guess at one time or another any computer hobbyist has wished for an EPROM progrmmer but the outlay of several hundred dollars *didn't seem* worthwhile. A commercial EPROM burner can cost from $500-$1000, with personality modules and a Radio Shack 232 interface as extras. Intronics has come to our rescue. Now for less than $90 you can buy an *EPROM Programmer* that, in my opinion, is better than the expensive models. How about you brave souls who have been thinking about changing some of the routines in the Extended BASIC ROMS?

Intronics *EPROM Programmer* is a TRS-80 compatible board that plugs into the expansion port. The 4" x 4¼" circuit is not in a housing since you need access to the low-insertion force socket on the board. Also, the board contains a power-on indicator and an off/on switch along with the necessary ICs. A 24 volt DC to DC converter is self-contained as this voltage is necessary for programming. I am very pleased with the appearance of the circuit board and construction. By the way, the EPROM socket has 28 pins for future state of the art changes. Different EPROMs are selected by means of a personality module. Five modules come with the unit and cover the normal range of EPROMs from 1 to 8K. Other personality modules are available for $5 each, such as a 68764, the EPROM replacement for the BASIC ROM.

Software for the programmer is supplied on cassette tape and uses addresses $2000-$3FFF for program memory. Commands are as follows:

ERASED — Checks for $FF in all EPROM memory locations, the normal erased state.
PROGRAM — Memory from the buffer is programmed into the EPROM.
VERIFY — Compare the data in the EPROM and in the memory buffer.
SLIDE ROM — Moves the data from the EPROM to the memory buffer.
SLIDE MEMORY — Moves memory from one location to another.
EXAMINE/CHANGE MEMORY — Modify buffer, or other memory.
RETURN TO BASIC — Return to BASIC.

The menu is well prompted and user friendly. All of the functions worked flawlessly. The memory examine/change command could use a few bells and whistles, but works as intended. The beauty of this system is in the fact that any program that will load into the CoCo can be moved into the buffer, modified if necessary, and burnt into an EPROM.

As you can tell I was impressed by the *EPROM Programmer,* especially after using units that cost ten times as much and having to manipulate disk files, edit programs, etc., just to enter data into the programmer. I tried assembling a program in memory, moving it to the buffer, and burning an EPROM. Each step worked without a hitch. The documentation leaves a little bit to be desired but due to prompts in the software it is adequate. I would suggest that instructions be included for the uninitiated to explain how to modify a ROM pack to accept different EPROMs, and for that matter, a short explanation of the different types. I would recommend this unit for both hobby and commercial use. You may be better off buying a CoCo and this unit than a Pro-Log—it certainly would be cheaper.

(Intronics, P.O. Box 13723, Edwardsville, KS 66113, $85)

—Dan Downard

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Contributions to *the RAINBOW* are welcome from everyone. We like to run a variety of programs which will be useful/helpful/-fun for other CoCo owners.

Program submissions must be on tape or disk and it is best to make several saves, at least one of them in ASCII format. We're sorry, but we do not have time to key in programs. All programs should be supported by some editorial commentary, explaining how the program works. We're much more interested in how your submission works and runs than how you developed it. Programs should be learning experiences.

We do pay for submissions, based on a number of criteria. Those wishing remuneration should *so state* when making submissions.

For the benefit of those who wish more detailed infor-mation on making submissions, please send a SASE to: Submissions Editor, *the RAINBOW*, P.O. Box 209, Prospect, KY 40059. We will send you some more comprehensive guidelines.

Please do not submit programs or articles currently submitted to another publication.

Disk Operator Reveals Powerful New Routines

By Roger Schrag

Radio Shack thoughtfully included a technical information section in their Color Computer disk system manual. This section was designed for machine language programmers who wanted to incorporate disk I/O into their programs.

Unfortunately, the information provided is in most cases perfectly useless. The one routine within the disk ROM that they show you how to use will merely read or write an individual sector on the diskette. The programmer must write his own routines to locate a file on the diskette, allocate disk space, create new files, delete old files, shut off the disk drive motor when it is not in use...and the list of responsibilities left for the poor programmer to take care of goes on and on.

Code	Abbr	Description
19	AO	File already open
20	DN	Bad device or drive number
21	IO	Input/output error
22	FM	Bad file mode
23	NO	File not open
24	IE	Input past end of file
27	NE	File not found
29	DF	Disk space full
30	OB	Out of buffer space
31	WP	Diskette write protected
32	FN	Bad filename
33	FS	Bad file structure
37	VF	Verification error

Table 1: Error Codes

What I would like to present here is a program that will perform a potpourri of disk-oriented operations. I have carefully scrutinized the disk ROM, and come up with some powerful routines that Radio Shack never told you about. The program contains seven routines that are analogous to the BASIC statements Files, Open, Close, Print#, Input#, Kill and Verify. Each routine does a complete job. Your program will need to do a minimal amount of work, such as supplying a filename or device number.

Please have a thorough understanding of the BASIC statements mentioned above before proceeding onward. Also please note that only the sequential input and output modes are supported; the direct access mode is *not* supported. Neither is cassette I/O. I hope to cover both of these topics in a future article.

$000	Basic program
$0FF	Basic program in ASCII format
$100	Data stored in binary
$1FF	Data stored in ASCII
$200	Machine language program
$300	Text stored in binary
$3FF	Text stored in ASCII

Table 2: File Types

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The source code shown in Listing 1 may be appended onto your program to give it disk I/O capabilities. Now let's look at each of the seven routines and see how they are used.

The Files routine organizes the disk system's area of memory by dividing it into smaller segments called buffers. Each buffer is 281 bytes, and is used by the disk system to work with a file while it is open.

For this many buffers	Don't use any memory below
0	$OBA2
1	$OCBB
2	$ODD4
3	$OEED
4	$1OO6
5	IIIF
6	$I238
7	I35I
8	I46A
9	I583
10	$I69C
11	I7B5
12	$I8CE

Table 3: Reserved Memory

You should use the Files routine at the beginning of your program in order to initialize and organize the disk system's memory. Decide on the maximum number of files you will want to have open at any given time; this is the number of buffers you will need. Put this figure into the B register and call the Files routine. Be sure that the buffer area won't overlap your program. Table 3 lists the boundary lines. This example would allocate space for six files, thus allowing your program to use device numbers of 1, 2, 3, 4, 5 or 6:

```
LDB     #$6       WE WANT SIX BUFFERS
JSR     FILES     GO SET UP MEMORY
```

The Open routine works in much the same way that the BASIC statement works. You will need to prepare the X,Y, A, and B registers with certain data before calling the routine. The X register must be loaded with the starting address of where in memory the filename is stored. Any filename that is valid in BASIC is valid here. Don't put quotes around the name, and if you don't specify an extension, then none will be used. Place a zero or $OD (ASCII code for a carriage return) after the last character in the filename, so that the routine will be able to tell how many characters long the name is.

Next, the Y register must be loaded with the file type. A list of file types is shown in Table 2. A file's type will appear in a directory generated by the DIR statement from BASIC.

The A register must be loaded with the mode you would like to use. Use $49 (ASCII code for I) for the input mode, and $4F (ASCII code for O) for the output mode. Finally, you will need to load the B register with the device number you wish to assign to this file. Be sure that you have set aside enough buffer space with the Files routine.

When you have all four registers set up properly, you are

™TRS80 color

From the January 1981 issue of the CSRA Computer Club newsletter:

> There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical informations on the TRS-80 color computer™. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

NOTE: This and other interesting and needed articles for the Radio Shack TRS-80 color computer™ are being included monthly in 68 Micro Journal—The Largest specialty computer magazine in the world!

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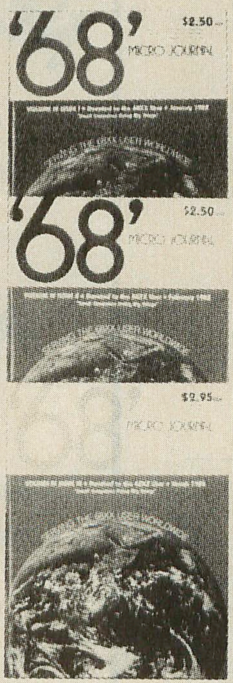

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Currently, and even before the Color Computer™ hit the stores, **68 Micro Journal™** was devoting more space to the TRS-80C Color Computer™ and information concerning the Motorola 6809 (which is the CPU in the Color Computer™) than ANY OTHER Computer Magazine. Examples include:
REVIEWS of the three major Disk Control Systems for the Color Computer™, most of the Monitors, Assemblers, and Disassemblers, Word Processors and Editors, "Terminal" Programs (for use with Modems, Communications with other Computers, etc.), and of course, Games.
HINTS for Expanding Memory, Power Supply Cooling, repairing sticky keyboards, disabling the ROM PAK "Take Over", hooking up to Printers, etc.
DISCUSSIONS of the 6883 Synchronous Address Multiplexer, using the Color Computer™ with 64K and 96K memory (which it is ALREADY capable of handling), thoughts on Programming, etc.

I suggest that you subscribe to **68 Micro Journal™**, SOON, as many back issues are sold-out.

We still, and will continue to, lead in the type information you need to **FULLY UTILIZE the POWER of the 6809 in the Radio Shack TRS-80 Color Computer™**.

Bob Nay
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Color Computer Editor

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ready to call the Open routine to open the file. This example will open an ASCII data file for output. The filename will be CHECKS/DAT:I, and device number two will be used. Note that the quote marks are used here as delimiters for the FCC instruction:

```
         LDX  #NAME     ADDRESS OF FILENAME
         LDY  #$IFF     FILE TYPE: ASCII DATA
         LDA  #$4F      OUTPUT MODE
         LDB  #$2       USE DEVICE NUMBER
                        TWO
         JSR  OPEN      GO OPEN THE FILE
         JMP  MORE      PROGRAM CONTINUES...
NAME     FCC  "CHECKS/DAT:I"
         FCB  $O        TERMINATOR
```

The Close routine will close a particular file and update the diskette if necessary. To close a file, load the device number into the B register and call the Close routine. Note that no error will occur if you try to close an already closed file. This example will close device number three:

```
         LDB  #$3       DEVICE NUMBER THREE
         JSR  CLOSE     GO CLOSE THE FILE
```

The Print routine will write a byte of data to a file which is open in the output mode. To use the routine, put the device number of the file you wish to write to in the B register, and the ASCII code of the character you wish to write in the A register. Then call the Print routine. Note that this routine will only write to one character at a time; you will need a simple loop to write groups of characters, or entire messages. This example will write the message "Accounts payable" to device number one:

```
        LDX  #MESAGE  START OF MESSAGE
LOOP    LDA  ,X+      GET CHARACTER
        TSTA          CHECK FOR END
        BEQ  MORE     GO ON IF ALL DONE
        LDB  #$I      TO DEVICE NUMBER
                      ONE
        JSR  PRINT    GO WRITE CHARACTER
        BRA  LOOP     LOOP BACK FOR AN-
                      OTHER
MESAGE  FCC  "ACCOUNTS PAYABLE"
        FCB  $O       TERMINATOR
```

The Input routine will read a byte of data from a file open in the input mode. To use the routine, place the device number of the file you wish to read from into the B register and call the Input routine. The A register will now contain the ASCII code of the character read from the file. Note that, once again, you will need a simple loop to deal with entire groups of characters. This example will read a character from device number four and display it in the upper left corner of the screen:

```
        LDB  #$4      FROM DEVICE NUMBER
                      FOUR
        JSR  INPUT    READ A CHARACTER
        STA  $400     DISPLAY ON SCREEN
```

The Kill routine will delete a file from the directory and

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free up any diskette space that was allocated to it. To kill a file, load the X register with the address of the filename and call the Kill routine. This example will delete a file named STOCKS/FEB:

```
        LDX  #NAME       ADDRESS OF FILENAME
        JSR  KILL        DELETE THE FILE
        JMP  MORE        PROGRAM CONTINUES
NAME    FCC  "STOCKS/FEB"
        FCB  $O          TERMINATOR
```

The Verify routine will either activate or deactivate the verification system. With this system turned on, the disk system will automatically verify all write operations. To use the routine, load the status code into the B register and call the Verify routine. One means on, zero means off. This example will turn the verification system on:

```
        LDB  #$I         ONE MEANS TURN IT ON
        JSR  VERIFY      ACTIVATE VERIFY SYS-
                         TEM
```

Each of the seven routines will handle reasonable error conditions—such as a write protected diskette, an improperly mounted diskette, or a file not found in the directory. However, the routines are not thoroughly bomb-proof. If, for example, you try to write data to device number 47, strange things will surely happen.

After calling a routine, the B register will contain zero and the Z flag in the condition code register will be set if the operation was performed successfully. If an error has occurred, then the Z flag will be reset, and the value in the B register will be the error code. Table 1 contains a listing of various error codes. This program uses the error vector at $I8E to handle error conditions. However, no problems should arise if your program also uses this vector, unless you are working with interrupt driven software.

The routines will preserve all registers except for B and CC. The one exception to this rule is the Input routine which will replace the previous contents of the A register with the ASCII code of the character read in from the file. Note that your program may redefine the Direct Page register. The register will be temporarily reset to zero so that the ROM routines will function properly, and then it will be reset to its previous value.

If you don't specify a drive number in the filename, drive zero will be used as the default. To change the default, store the desired drive number at memory location $95A. This example will make drive one the default drive:

```
        LDB  #$I         SELECT DRIVE ONE
        STB  $95A        AS THE DEFAULT DRIVE
```

Also remember that interrupts must be enabled whenever the disk system is being used. Otherwise, the disk drive motor will not shut off after two seconds of non-use. Most of the routines will automatically enable interrupts.

Listing 2 is a demonstration program, showing how the seven routines may be used. The program will allow you to type words on the screen. Press the Break key when you are done. The computer will now save the contents of the screen to disk under the name of DEMO/DAT. When you press Break again, the image will be loaded back in and put on the screen backwards. Press Break again, and the file DEMO/-DAT will be killed and you will be returned to BASIC. Of course, this program has no real applications, but it does show the essential techniques for using the seven routines. I have included lots of comments to make it easier to understand.

If you have any questions, comments, or requests for future article topics, feel free to drop me a line at 2054 Manning Avenue, Los Angeles, Calif., 90025. Please include a self-addressed, stamped envelope. The source code for both listings is available from the author for five dollars at the above address. I'll supply it on tape to ease mailing, but it is readily transferable to disk.

Good luck, and may you input a character for each that you output.

(Roger Schrag, a highschool senior, enjoys working with the CoCo and writing for ***the Rainbow.*** *He also designs and translates programs for Adventure International.)*

Listing 1

```
62000 ******************************
62010 * MACHINE LANGUAGE DISK I/O *
62020 ******************************
62030 *
62040 * VERSION 1.0 - MARCH 1, 1983
62050 *
62060 * ROGER SCHRAG
62070 * 2054 MANNING AVENUE
62080 * LOS ANGELES, CA 90025
62090 *
62100 *
62110 *THIS CODE IS INTENDED TO BE
62120 *APPENDED ON TO YOUR OWN
62130 *PROGRAM, SO YOU MUST SUPPLY
62140 *THE ORG STATEMENT. IT MAY
62150 *RESIDE ANYWHERE IN RAM
```

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Auto Run will generate a machine language loader program to preceed your program on the tape. Then, to start up your program, simply type CLOADM to load in the Auto Run loader program, which will then automatically start itself up, display your title screen, load your program and then RUN or EXEC it.

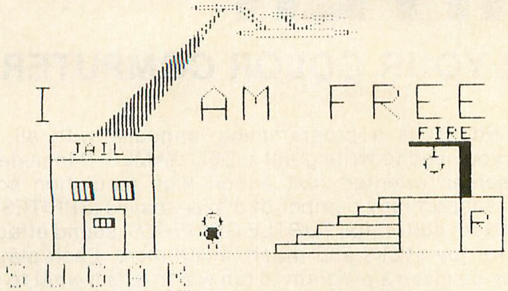
Also you may record a vocal or musical introduction preceding your program. The Auto Run loader will control the audio on/off.

Basic programs can be set to load anywhere in memory above $600 (the PCLEAR 0 page).

Software authors: The Auto Run prefix may be appended to your software products.

Auto Run is **$14.95** and includes complete documentation and an assembly source listing.
Requires 16K Extended Basic.

Galactic Hangman



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```
62160 *
62170 *
62180 SAVE    FCB     $0         3 BYTE STORAGE
62190           FCB     $0         AREA FOR THE
62200           FCB     $0         ERROR VECTOR
62210 STACK   FCB     $0         2 BYTE STORAGE
62220           FCB     $0         AREA FOR STACK POINTER
62230 *
62240 *
62250 *ROUTINE TO INITIALIZE DISK
62260 *SYSTEM'S MEMORY
62270 *     B=NUMBER OF BUFFERS
62280 *
62290 FILES   LBSR    BEGIN      PREPARE
62300           PSHS    B          SAVE # OF BUFFERS
62310           JSR     $CA3B      CLOSE ALL FILES
62320           PULS    B          RESTORE # OF BUFFERS
62330           STB     $95B       STORE # OF FILES
62340           LDU     #$928      START OF BUFFER TABLE
62350           LDX     #$989      START OF BUFFER AREA
62360 DOBUF   CLR     ,X         CLEAR STATUS FLAG
62370           STX     ,U++       PUT ENTRY IN TABLE
62380           LEAX    $119,X     GO TO NEXT BUFFER
62390           DECB               DECREMENT COUNT
62400           BHI     DOBUF      LOOP BACK UNTIL DONE
62410           LBRA    DONE       FUNCTION COMPLETE
62420 *
62430 *
62440 *ROUTINE TO OPEN A FILE
62450 *     X=ADDR OF FILENAME
62460 *     Y=FILE TYPE
62470 *     A=FILE MODE
62480 *     B=DEVICE NUMBER
62490 *
62500 OPEN    LBSR    BEGIN      PREPARE
62510           STY     $957       STORE TYPE
62520           PSHS    D          SAVE MODE & DEVICE
62530           LBSR    FNAME      PROCESS FILENAME
62540           PULS    D          RESTORE MODE & DEVICE
62550           JSR     $C468      GO OPEN FILE
62560           LBRA    DONE       FUNCTION COMPLETE
62570 *
62580 *
62590 *ROUTINE TO CLOSE A FILE
62600 *     B=DEVICE NUMBER
62610 *
62620 CLOSE   LBSR    BEGIN      PREPARE
62630           STB     $6F        STORE DEVICE NUMBER
62640           JSR     $CA53      GO CLOSE FILE
62650           LBRA    DONE       FUNCTION COMPLETE
62660 *
62670 *
62680 *ROUTINE TO WRITE TO A FILE
62690 *     A=CHARACTER TO WRITE
62700 *     B=DEVICE NUMBER
62710 *
62720 PRINT   LBSR    BEGIN      PREPARE
62730           STB     $6F        STORE DEVICE NUMBER
62740           JSR     $A282      WRITE CHARACTER
62750           LBRA    DONE       FUNCTION COMPLETE
62760 *
62770 *
62780 *ROUTINE TO READ A CHARACTER
62790 *FROM A FILE
62800 *     B=DEVICE NUMBER
62810 *     A RETURNS WITH INPUT CHARACTER
62820 *
62830 INPUT   LBSR    BEGIN      PREPARE
62840           STB     $6F        STORE DEVICE NUMBER
62850           JSR     $A176      GO INPUT CHARACTER
62860           STA     ,S         PUT IT ON STACK
62870           LBRA    DONE       FUNCTION COMPLETE
62880 *
62890 *
62900 *ROUTINE TO KILL A FILE
62910 *     X=ADDR OF FILENAME
62920 *
62930 KILL    LBSR    BEGIN      PREPARE
62940           LBSR    FNAME      PROCESS FILENAME
62950           JSR     $C6C5      GO KILL FILE
62960           LBRA    DONE       FUNCTION COMPLETE
62970 *
62980 *
62990 *ROUTINE TO ACTIVATE/DEACTIVE
```

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```
63000 *THE VERIFICATION SYSTEM
63010 *     B=1 (ACTIVATE)
63020 *     B=0 (DEACTIVATE)
63030 *
63040 VERIFY  LBSR     BEGIN      PREPARE
63050         STB      $987       STORE STATUS
63060         LBRA     DONE       FUNCTION COMPLETE
63070 *
63080 *
63090 *THE ROUTINES BELOW ARE FOR
63100 *INTERNAL USE ONLY, AND ARE NOT
63110 *TO BE CALLED BY YOUR PROGRAM
63120 *DIRECTLY!
63130 *
63140 *
63150 *ROUTINE TO PROCESS FILENAME
63160 *
63170 FNAME   LDB      #$FF       CLEAR COUNTER
63180 GETLEN  INCB                CALCULATE HOW
63190         LDA      B,X        MANY LETTERS
63200         CMPA     #$20       ARE IN THE
63210         BCC      GETLEN     FILENAME
63220         CLR      ,-S        MAKE SPACE ON STACK
63230         LDA      $95A       GET DEFAULT DRIVE # IN
63240         STA      $EB        CASE NONE IS SPECIFIED
63250         LDU      #$94C      NAME STORAGE AREA
63260         LDA      #$20       ASCII CODE FOR BLANK
63270 CLEAR   STA      ,U+        CLEAR OUT
63280         CMPU     #$957      FILENAME
63290         BNE      CLEAR      STORAGE AREA
63300         JMP      $C8A4      GO PROCESS FILENAME
63310 *
63320 *
63330 *ROUTINE TO PREPARE EVERYTHING
63340 *PRESERVE REGISTERS, SET UP
63350 *ERROR TRAP, ETC
63360 *
63370 BEGIN   PSHS     X,Y,U,DP,A  SAVE REGISTERS
63380         CLRA                TEMPORARILY SET
63390         TFR      A,DP       DP TO ZERO
63400         LDA      $18E       GET CONTENTS OF
63410         LDU      $18F       ERROR VECTOR
63420         STA      SAVE,PCR      AND SAVE IT
63430         STU      SAVE+1,PCR    FOR NOW
63440         LDA      #$7E          NOW SET UP
63450         LEAU     ERROR,PCR     ERROR VECTOR
63460         STA      $18E       WITH OUR OWN
63470         STU      $18F       HANDLING ROUTINE
63480         LDA      ,S         RESTORE A REGISTER
63490         STS      STACK,PCR  SAVE STACK POINTER
63500         JMP      [8,S]      RETURN
63510 *
63520 *
63530 *IF AN ERROR OCCURS, CONTROL
63540 *WILL PASS TO ERROR ROUTINE
63550 *
63560 ERROR   LSRB                B=ERROR CODE
63570         INCB                DIVIDE BY 2, ADD 1
63580         BRA      EXIT       GO TO EXIT ROUTINE
63590 *
63600 *
63610 *IF ROUTINE FINISHES PROPERLY,
63620 *CONTROL WILL PASS TO DONE
63630 *
63640 DONE    CLRB                0=NO ERROR
63650         BRA      EXIT       GO TO EXIT ROUTINE
63660 *
63670 *
63680 *ROUTINE TO RESTORE REGISTERS AND
63690 *ERROR VECTOR, AND RETURN TO
63700 *CALLING PROGRAM
63710 *
63720 EXIT    LDA      SAVE,PCR   RESTORE THE
63730         LDU      SAVE+1,PCR ERROR VECTOR
63740         STA      $18E       TO ITS ORIGINAL
63750         STU      $18F       VALUE
63760         LDS      STACK,PCR  RESTORE STACK POINTER
63770         PULS     A,DP,U,Y,X RESTORE REGISTERS
63780         LEAS     2,S        CLEAN UP STACK
63790         TSTB                SET Z FLAG IF NO ERROR
63800         RTS                 RETURN TO CALLER
63810         END      START
```

ARK ROYAL GAMES

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All games available on Disk .... Add $3.00

Listing 2:

```
00100 *DEMONSTRATION PROGRAM
00110 *MACHINE LANGUAGE DISK I/O
00120 *BY ROGER SCHRAG
00130 *
00140 *
00150         ORG     $1000   START ABOVE BUFFER AREA
00160 START   LDB     #$1     WE WANT 1 BUFFER
00170         JSR     FILES   SET UP MEMORY
00180         LDB     #$1     ACTIVATE THE
00190         JSR     VERIFY  VERIFICATION SYSTEM
00200         JSR     $A928   CLEAR SCREEN
00210 WAIT    LDA     #$FF    RED GRAPHIC BLOCK
00220         STA     [$88]   SHOW CURSOR
00230         JSR     [$A000] SCAN KEYBOARD
00240         BEQ     WAIT    WAIT UNTIL KEY PRESSED
00250         CMPA    #$3     BREAK PRESSED?
00260         BEQ     SAVEIT  GO SAVE SCREEN IF SO
00270         LDB     #$60    ERASE THE
00280         STB     [$88]   CURSOR
00290         JSR     $A30A   PRINT CHARACTER
00300         BRA     WAIT    LOOP BACK
00310 SAVEIT  LDA     #$60    ERASE THE
00320         STA     [$88]   CURSOR
00330         LDX     #NAME   ADDR OF NAME
00340         LDY     #$1FF   FILE TYPE: ASCII DATA
00350         LDA     #$4F    OUTPUT MODE
00360         LDB     #$1     DEVICE NUMBER ONE
00370         JSR     OPEN    GO OPEN FILE
00380         BNE     GOOFED  GO IF ERROR
00390         LDX     #$400   TOP OF SCREEN
00400 WRITE   LDA     ,X+     GET CHARACTER
00410         LDB     #$1     DEVICE NUMBER ONE
00420         JSR     PRINT   WRITE CHARACTER
00430         BNE     GOOFED  GO IF ERROR
00440         CMPX    #$600   END OF SCREEN?
00450         BNE     WRITE   LOOP BACK IF NOT
00460         LDB     #$1     DEVICE NUMBER ONE
00470         JSR     CLOSE   CLOSE FILE
00480         BNE     GOOFED  GO IF ERROR
00490         JSR     $A928   CLEAR SCREEN
00500         JSR     BREAK   WAIT FOR BREAK PRESSED
00510         LDX     #NAME   ADDR OF FILENAME
00520         LDY     #$1FF   FILE TYPE: ASCII DATA
00530         LDA     #$49    INPUT MODE
00540         LDB     #$1     DEVICE NUMBER ONE
00550         JSR     OPEN    GO OPEN FILE
00560         BNE     GOOFED  GO IF ERROR
00570         LDX     #$600   END OF SCREEN
00580 READ    LDB     #$1     DEVICE NUMBER ONE
00590         JSR     INPUT   READ CHARACTER
00600         BNE     GOOFED  GO IF ERROR
00610         STA     ,-X     PUT ON SCREEN
00620         CMPX    #$400   TOP OF SCREEN?
00630         BNE     READ    LOOP BACK IF NOT
00640         LDB     #$1     DEVICE NUMBER ONE
00650         JSR     CLOSE   GO CLOSE FILE
00660         BNE     GOOFED  GO IF ERROR
00670         JSR     BREAK   WAIT FOR BREAK PRESSED
00680         JSR     $A928   CLEAR SCREEN
00690         LDX     #NAME   ADDR OF FILENAME
00700         JSR     KILL    DELETE FILE
00710         BNE     GOOFED  GO IF ERROR
00720         JSR     $A928   CLEAR SCREEN
00730         JMP     $A0F3   RETURN TO BASIC
00740 BREAK   JSR     [$A000] SCAN KEYBOARD
00750         CMPA    #$3     BREAK KEY PRESSED?
00760         BNE     BREAK   WAIT MORE IF NOT
00770         RTS             RETURN TO PROGRAM
00780 GOOFED  LDX     #ERRMSG MESSAGE "ERROR #"
00790 ERR1    LDA     ,X+     GET CHARACTER
00800         BEQ     ERR2    GO IF DONE
00810         JSR     $A30A   PRINT CHARACTER
00820         BRA     ERR1    LOOP BACK
00830 ERR2    LDA     #$2F    PRINT ERROR CODE
00840 ERR3    INCA            NUMBER ON SCREEN
00850         SUBB    #$0A    IN TWO DIGIT
00860         BCC     ERR3    DECIMAL FORMAT
00870         ADDB    #$3A    A=TENS  B=ONES
00880         JSR     $A30A   PRINT TENS
00890         TFR     B,A     GET ONES
00900         JSR     $A30A   PRINT ONES
00910         JMP     $A0F3   RETURN TO BASIC
00920 NAME    FCC     "DEMO/DAT"
00930         FCB     $0      TERMINATOR
00940 ERRMSG  FCC     "ERROR #"
00950         FCB     $0      TERMINATOR
00960 *
00970 *
00980 *THE DISK I/O PROGRAM HAS
00990 *BEEN APPENDED BELOW
01000 *
01010 *
01020 SAVE    FCB     $0      3 BYTE STORAGE
01030         FCB     $0      AREA FOR THE
01040         FCB     $0      ERROR VECTOR
01050 STACK   FCB     $0      2 BYTE STORAGE
01060         FCB     $0      AREA FOR STACK POINTER
01070 *
01080 *
01090 *ROUTINE TO INITIALIZE DISK
01100 *SYSTEM'S MEMORY
01110 *   B=NUMBER OF BUFFERS
01120 *
01130 FILES   LBSR    BEGIN   PREPARE
01140         PSHS    B       SAVE # OF BUFFERS
01150         JSR     $CA3B   CLOSE ALL FILES
01160         PULS    B       RESTORE # OF BUFFERS
01170         STB     $95B    STORE # OF FILES
01180         LDU     #$928   START OF BUFFER TABLE
01190         LDX     #$989   START OF BUFFER AREA
01200 DOBUF   CLR     ,X      CLEAR STATUS FLAG
01210         STX     ,U++    PUT ENTRY IN TABLE
01220         LEAX    $119,X  GO TO NEXT BUFFER
01230         DECB            DECREMENT COUNT
01240         BHI     DOBUF   LOOP BACK UNTIL DONE
01250         LBRA    DONE    FUNCTION COMPLETE
01260 *
01270 *
01280 *ROUTINE TO OPEN A FILE
01290 *   X=ADDR OF FILENAME
01300 *   Y=FILE TYPE
01310 *   A=FILE MODE
```

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"Watch for more peripherals from Basic Technology."

```
01320 *    B=DEVICE NUMBER
01330 *
01340 OPEN     LBSR    BEGIN    PREPARE
01350          STY     $957     STORE TYPE
01360          PSHS    D        SAVE MODE & DEVICE
01370          LBSR    FNAME    PROCESS FILENAME
01380          PULS    D        RESTORE MODE & DEVICE
01390          JSR     $C468    GO OPEN FILE
01400          LBRA    DONE     FUNCTION COMPLETE
01410 *
01420 *
01430 *ROUTINE TO CLOSE A FILE
01440 *    B=DEVICE NUMBER
01450 *
01460 CLOSE    LBSR    BEGIN    PREPARE
01470          STB     $6F      STORE DEVICE NUMBER
01480          JSR     $CA53    GO CLOSE FILE
01490          LBRA    DONE     FUNCTION COMPLETE
01500 *
01510 *
01520 *ROUTINE TO WRITE TO A FILE
01530 *    A=CHARACTER TO WRITE
01540 *    B=DEVICE NUMBER
01550 *
01560 PRINT    LBSR    BEGIN    PREPARE
01570          STB     $6F      STORE DEVICE NUMBER
01580          JSR     $A282    WRITE CHARACTER
01590          LBRA    DONE     FUNCTION COMPLETE
01600 *
01610 *
01620 *ROUTINE TO READ A CHARACTER
01630 *FROM A FILE
01640 *    B=DEVICE NUMBER
01650 *    A RETURNS WITH INPUT CHARACTER
01660 *
01670 INPUT    LBSR    BEGIN    PREPARE
01680          STB     $6F      STORE DEVICE NUMBER
01690          JSR     $A176    GO INPUT CHARACTER
01700          STA     ,S       PUT IT ON STACK
01710          LBRA    DONE     FUNCTION COMPLETE
01720 *
01730 *
01740 *ROUTINE TO KILL A FILE
01750 *    X=ADDR OF FILENAME
01760 *
01770 KILL     LBSR    BEGIN    PREPARE
01780          LBSR    FNAME    PROCESS FILENAME
01790          JSR     $C6C5    GO KILL FILE
01800          LBRA    DONE     FUNCTION COMPLETE
01810 *
01820 *
01830 *ROUTINE TO ACTIVATE/DEACTIVE
01840 *THE VERIFICATION SYSTEM
01850 *    B=1 (ACTIVATE)
01860 *    B=0 (DEACTIVATE)
01870 *
01880 VERIFY   LBSR    BEGIN    PREPARE
01890          STB     $987     STORE STATUS
01900          LBRA    DONE     FUNCTION COMPLETE
01910 *
01920 *
01930 *THE ROUTINES BELOW ARE FOR
01940 *INTERNAL USE ONLY, AND ARE NOT
01950 *TO BE CALLED BY YOUR PROGRAM
01960 *DIRECTLY!
01970 *
01980 *
01990 *ROUTINE TO PROCESS FILENAME
02000 *
02010 FNAME    LDB     #$FF     CLEAR COUNTER
02020 GETLEN   INCB             CALCULATE HOW
02030          LDA     B,X      MANY LETTERS
02040          CMPA    #$20     ARE IN THE
02050          BCC     GETLEN   FILENAME
02060          CLR     ,-S      MAKE SPACE ON STACK
02070          LDA     $95A     GET DEFAULT DRIVE # IN
02080          STA     $EB      CASE NONE IS SPECIFIED
02090          LDU     #$94C    NAME STORAGE AREA
02100          LDA     #$20     ASCII CODE FOR BLANK
02110 CLEAR    STA     ,U+      CLEAR OUT
02120          CMPU    #$957    FILENAME
02130          BNE     CLEAR    STORAGE AREA
02140          JMP     $C8A4    GO PROCESS FILENAME
02150 *
02160 *
02170 *ROUTINE TO PREPARE EVERYTHING
02180 *PRESERVE REGISTERS, SET UP
02190 *ERROR TRAP, ETC
02200 *
02210 BEGIN    PSHS    X,Y,U,DP,A  SAVE REGISTERS
02220          CLRA             TEMPORARILY SET
02230          TFR     A,DP     DP TO ZERO
02240          LDA     $18E     GET CONTENTS OF
02250          LDU     $18F     ERROR VECTOR
02260          STA     SAVE,PCR  AND SAVE IT
02270          STU     SAVE+1,PCR  FOR NOW
02280          LDA     #$7E     NOW SET UP
02290          LEAU    ERROR,PCR  ERROR VECTOR
02300          STA     $18E     WITH OUR OWN
02310          STU     $18F     HANDLING ROUTINE
02320          LDA     ,S       RESTORE A REGISTER
02330          STS     STACK,PCR  SAVE STACK POINTER
02340          JMP     [8,S]      RETURN
02350 *
02360 *
02370 *IF AN ERROR OCCURS, CONTROL
02380 *WILL PASS TO ERROR ROUTINE
02390 *
02400 ERROR    LSRB             B=ERROR CODE
02410          INCB             DIVIDE BY 2, ADD 1
02420          BRA     EXIT     GO TO EXIT ROUTINE
02430 *
02440 *
02450 *IF ROUTINE FINISHES PROPERLY,
02460 *CONTROL WILL PASS TO DONE
02470 *
02480 DONE     CLRB             0=NO ERROR
02490          BRA     EXIT     GO TO EXIT ROUTINE
02500 *
02510 *
02520 *ROUTINE TO RESTORE REGISTERS AND
02530 *ERROR VECTOR, AND RETURN TO
02540 *CALLING PROGRAM
02550 *
02560 EXIT     LDA     SAVE,PCR    RESTORE THE
02570          LDU     SAVE+1,PCR  ERROR VECTOR
02580          STA     $18E        TO ITS ORIGINAL
02590          STU     $18F        VALUE
02600          LDS     STACK,PCR   RESTORE STACK POINTER
02610          PULS    A,DP,U,Y,X  RESTORE REGISTERS
02620          LEAS    2,S        CLEAN UP STACK
02630          TSTB               SET Z FLAG IF NO ERROR
02640          RTS                RETURN TO CALLER
02650          END     START
```

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. . . avoid unreliable cassette tapes and recorders and EPROM your program!

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EPACK is an excellent alternative to cassettes for programs you want to sell and for personal programs you would like to execute quickly and conveniently from a more reliable medium.

NOTE: 2732, 2764 and 21 volt capability are available optionally and are **not included** in the standard EPACK. **

EPACK consists of **EPG, BROM** and **MMB** for **$150.00**

The units in EPACK are sold individually as follows:

BROM

Utility fits any memory size color computer. Its function is to process BASIC source files into a format that can be written out to EPROM by Control Craft Inc.'s EPROM programmer (EPG) . . . and still be executed by the BASIC interpreter - but from EPROM, not RAM!

BROM **$25.00**

EPROM PROGRAMMER (EPG)

- Zero insertion force socket
- Personality plugs configure programmer to accept 2716 (5 volt supply), 2532 and 2564 style EPROM.
- Programmer's software is included on the programmer board as firmware.
- Program sources:
  - * read cassette tape files into memory and then write file to EPROM (files are in Radio Shack format)
  - * write color computer RAM to EPROM
  - * read EPROM inserted in programmer into RAM
  - * write color computer ROM to EPROM
- Functions:
  - * test EPROM to see if it's unprogrammed
  - * read an EPROM into color computer RAM
  - * write RAM buffer out to EPROM
  - * redefine the location of the RAM buffer
  - * verify the programming of an EPROM
  - * compare the contents of RAM buffer against an EPROM
  - * edit the RAM buffer
    1. Examine/change memory locations
    2. Examine/change start buffer address
    3. Fill RAM buffer with FF hex
  - * read blocks from a cassette file into RAM
- Menu driven operation allows easy use
- Plastic case enclosed circuitry
- Gold plated edge connectors
- Self-contained unit . . . no external power supplies are used
- Unit operates on any memory sized TRS-80 color computer

EPG **$105.00**

MULTI MEMORY BOARD (MMB)

- Complete with support IC, sockets and decoupling capacitors
- Accepts 2516, 2716, 2532, 2732, 2564 EPROM (included in EPACK)
- Accepts 2016, 4016, 6116 static RAM*
- Max capacity of 6 memory chips
- Runs on any size TRS-80 color computer
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- Jumpers configure the memory type used on the board. Provisions for inserting DIP switches in place of the jumpers
- Gold plated edge connector
- Each IC or IC socket has decoupling cap installed
- Plastic case is available extra, at $7.50 (pricing is subject to change without notice) (case included in EPACK)

* RAM may not work with series E or later color computers.

MMB **$30.00**

** **UPGRADE** (optional for EPACK or EPG)			
2732-25 volt	**$15.00**	2732-21 volt	**$15.00**
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OKIDATA owners know that in order to print graphics they lose their serial interface . . .

NOT ANY MORE!

Now you can print Hi-res Pmode 4 graphics images, full size and detail, on your OKIDATA, EPSON and other printers, without dot addressable capacity.

Features:

- Callable from BASIC routine
- Runs stand alone with a menu
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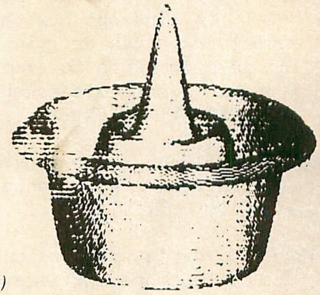
- Useable on 16 or 32 or 64 K machines with or without Extended BASIC
- Documented



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Actual graphics printed on an OKIDATA printer (shown reduced)

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Shipping address (if different from above)

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Order Form:

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MMB	____	@	$ 30.00 =	______
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Accounting Program Has Uses Beyond Tax Preparations

CoCo-Accountant is an inexpensive home accounting program from Federal Hill Software that allows the user to keep track of checks written. The object of the program is to allow for easy retrieval and sorting of this information at tax time from the files that may be kept on casette or disk, depending on the version purchased. The cassette version comes in both 16K or 32K while the disk version may only be used with 32K.

I have had no training in accounting and thus I would have no idea how close this program adheres to regular accounting practices. Since I do take care of the finances for my family as well as the yearly chore of income tax, I do see how useful the information that may be generated from this program would be. The program will list and total each month's checks, list and total checks by account for a given month or year, and display all information on the screen or printer. In addition, the 32K versions will flag tax deductible expenses and checks subject to sales tax. In the latter case, the user need only type in the state's sales tax and the program will calculate the total amount of sales tax spent within these flagged purchases.

Getting the program set up and operating is easy due to very complete and well-written documentation (nine pages) and a menu/prompt system built into the program itself. After loading the program for the first time, the user may define up to 24 accounts and a two-letter account code. The user may then enter check information from the keyboard or the storage medium. It is very important to remember each account's code or the program will not operate correctly. There is an option on the main menu that will list accounts and codes if the user forgets, but unfortunately you can't make a printed copy of this list. Other options from the main menu allow the user to list checks by month, account or payee, to make a year-to-date summary, to sort by date, correct an error, and list all checks. The printer routine supports a 45-column printout of any information wanted from most of the various "list" options.

INSIM Instruction Simulator
Simulates the complete 6809 instruction set.
Use it to quickly debug assembly programs.
Use it to find out how other programs work.
Use it to find out how the basic roms work.
Output to screen or printer.
Includes commands to examine and change memory.
Fven has a mini-disassembler
16K STANDARD/EXTENDED........................$39.95

COMPRESS Reduce basic program size.
Removes spaces and comments.
4K OR 16K....................................$7.95

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Calculates home mortgage payments or any loan payments.
Calculates interest, total interest, total paid, amount due.
Calculates how much to invest now to retire in style in 30 years.
This program will calculate future values, present values and much more!
16K STANDARD.................................$12.95

DEPREC Calculate depreciation using:
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RAINBOW CERTIFICATION SEAL

I did find some limitations in the program that may limit the usefulness of the system for some users. The 32K disk version allows for up to 400 checks to be entered. I was surprised to discover that I write about 480 checks a year and that I would have to split the program into half-years to be able to use it. The cassette 32K version will take up to 450 checks and the 16K cassette version has a capacity of 200. This program is not a checkbook balancer as there is no way to enter credits or deposits. The documentation plainly states that the program is a way to organize *cancelled* checks only. If you like to balance your checkbook with your Color Computer, you will thus be obligated to enter your check information twice—once for your checkbook program and again for this program. Finally, the program is based around check writing only, and thus the reality of credit card or cash spending is not taken into account. I would suspect that organizing credit spending would be as important to some people as watching the checks.

Despite the limitations mentioned, I can see some excellent uses for a program such as *CoCo-Accountant.* Besides the obvious tax preparation advantages, an easily accessed record of, say, gasoline, energy or computer expenses would be useful for many people to watch where the money is going. When you measure the very reasonable price of this program against value received, I think value is the winner.

(Federal Hill Software, 825 William Street, Baltimore, MD 21230, 16K/32K cassette $15.95, 32K disk $21.95)

—Brian James

Graphics Hint . . .

To 'B' or Not to 'B' That is the Option

The Extended BASIC book tells us to always use the B option directly before the M motion command when moving the draw position. Their reasoning is that you may get unwanted lines. My point here is that you may be able to omit the B option and get WANTED lines a lot easier than with any other method. I have used this method on several occasions and it can be of great help. It is useful anytime you need to draw a line from a point to another point that does not fall on one of the standard angles (U E R F D G L H). The N (no update) option also seems to work well with this method. I'm sure many people are aware of this ability, but I have never seen anything about it and it can be very helpful.

Harvey R. Hall
Inola, OK

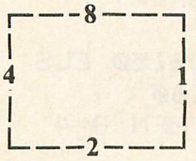
Dots: A Change Of Pace From Outer Space

By Daniel W. Phillips

Here's a beginner strategy game that most everyone has played at one time or another. It's a change of pace from the outer space craze, and easy to play for even the younger kids. The computer allows no 'extra' moves or 'missed' captures. A nice feature of this electronic version of Dots is that the computer will start the game for you with 60 random lines. Of course, you can start from scratch if you like. Instructions for the game are in the program.

I've included a liberal sprinkling of *REMarks* on the flow and control of the game in the listing, however, a little background information may be helpful if you want to make any changes or additions to the game.

The numbering scheme I used for this game appeared in a November 1982 *Popular Computing* article by George Stewart, titled Making Mazes. Values for the sides and box are as follows:

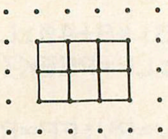


- 0 — No Lines
- 1 — Right Side
- 2 — Bottom
- 4 — Left Side
- 8 — Top
- 16 — Captured Box

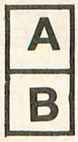
A complete box will total 15.

The value of the box is stored in the game array A(C,R), where "C" is the column and "R" is the row.

I used only two lines to make a box. The top and left side are the two lines used for computing values.



As you can see, the side of one box is also the opposite side of its adjacent box.



That is, the top of box 'A' is the same line as the bottom of box 'B'.

The value of both boxes must be revised when one line is drawn.

Although we are concerned only with values of the ten by ten boxes on the board, we need eleven columns and rows for drawing lines. Column eleven will draw the right side on the far right, and row eleven will draw the bottom line for the bottom boxes.

The search routines are simply a series of comparisons. The values chosen for comparison are sums of the line values for partially completed boxes. The order of comparison was arranged to equalize the time used for all searches. That is, instead of having a 'north' search zip along and a 'south' search barely crawl, both should take approximately the same length of time.

And that's about it!

Variable List

LP,LH,LV	Left Joystick
RP,RH,RV	Right Joystick
H,V	Gameboard Locations
C,R	Column and Row
B	Flag—Color of Player
D	Return Dot to Original Color Counter for Random Lines
F	Flag to Indicate Capture
FP	Flag for Joystick Control Flag for Subroutine Returns
X,Y	Work Variables
SR,SL,ST	Scores
A(11,11)	Game Array — Column — Row
N$(10)	Work INKEY$—Store Number Strings (not dimensioned)

79	0389
169	0758
289	0AAD
370	0EA9
559	127A
739	1641
END	1A16

The listing:

```
10 CLS:PMODE1,1:COLOR1,2:PCLS:PR
INT@205,"DOTS":PRINT@234,"WRITTE
N FOR":PRINT@263,"COLOR COMPUTER
 BY":PRINT@297,"DAN PHILLIPS":PR
INT@451,"FOR INSTRUCTIONS PRESS
'I'          ANY OTHER KEY TO PLAY
";
20 N$=INKEY$:IFN$=""THEN20 ELSE
IF N$="I" GOSUB740 ELSE CLS
30 PRINT@323,CHR$(175)" OR "CHR$
(239)" WILL BE RIGHT PLAYER":PRI
NT@355,CHR$(191)" OR "CHR$(255)"
 WILL BE LEFT PLAYER"
39 REM STRINGS FOR NUMBERS
   ORIGINALLY IN A PROGRAM BY
   RON VAN DYKE IN THE APRIL 82
   TRS 80 MICROCOMPUTER NEWS
40 N$(0)="BM+1,0;H1U4E1R2F1D4G1L
2;BM+6,0":N$(1)="BM+1,0;R1NR1U6G
1;BM+6,+5":N$(2)="NR4U1E1R1E2U1H
1L2G1;BM+7,+5"
50 N$(3)="BM+0,-1;F1R2E1H2E2H1L3
;BM+7,6":N$(4)="BM+3,0;U2NR1L3U1
E3D3;BM+4,3":N$(5)="BM+0,-1;F1R2
E1U2H1L3U2R4;BM+3,+6"
60 N$(6)="BM+4,-5;H1L2G1D4F1R2E1
U1H1L3;BM+7,+3":N$(7)="U1E4U1L4;
BM+7,+6":N$(8)="BM+1,-0;H1U1E1H1
U1E1R2F1D1G1NL2F1D1G1L2;BM+6,0"
70 N$(9)="BM+0,-1;F1R2E1U4H1L2G1
D1F1R2;BM+4,+3":N$(10)="D18R36U1
8"
79 REM LIST ALL VARIABLES IN
   ORDER OF MOST USE..SET ARRAY
   TO ZERO
80 DIM A(11,11):X=0:Y=0:RH=0:RV=
0:RP=0:LH=0:LV=0:LP=0:H=0:V=0:FP
=0:D=0:C=1:R=1:B=4:ST=0:SL=0:SR=
0:F=1:FOR R=1TO11:FOR C=1TO11:A(
C,R)=0:NEXT C,R
89 REM DRAW GAMEBOARD
90 DRAW"BM46,0"+N$(10):DRAW"BM11
0,0"+N$(10):DRAW"BM174,0"+N$(10)
:PAINT(1,1),1,1:GOSUB150:GOSUB16
0:COLOR2,1:FORX=48TO208 STEP16:F
ORY=20TO180 STEP16:PSET(X,Y,2):N
EXTY,X
100 FORX=1TO5:N$=INKEY$:NEXT:PRI
NT@419,"WOULD YOU LIKE SOME RAND
OM       LINES TO GET STARTED?"
:PRINT@493,"<Y-N>";
110 N$=INKEY$:IFN$=""THEN110ELSE
X=RND(2)-1:SCREEN1,X
120 IFN$="Y"THENFP=-1:X=RND(-TIM
ER):GOSUB650:FP=1:GOTO180:ELSE 1
80
129 REM DRAW HORIZONTAL LINES
130 H=(C*16)+32:V=(R*16)+4:FOR X
=H TO (H+16):PSET(X,V,2):NEXTX:R
ETURN
139 REM DRAW VERTICAL LINES
140 H=(C*16)+32:V=(R*16)+4:FOR X
=V TO (V+16):PSET(H,X,2):NEXTX:R
ETURN
149 REM COMPUTE AND DISPLAY
    SCORE FOR RIGHT PLAYER
150 X=INT(SR/10):Y=SR-(X*10):PAI
NT(178,2),3,1:DRAW"C2;S10;BM180,
14"+N$(X)+N$(Y):RETURN
159 REM COMPUTE AND DISPLAY
    SCORE FOR LEFT PLAYER
160 X=INT(SL/10):Y=SL-(X*10):PAI
NT(50,2),4,1:DRAW"C2;S10;BM52,14
"+N$(X)+N$(Y):RETURN
169 REM ANY CHANGE IN SCORE -DO
    ANOTHER SEARCH
170 IF ST<>(SR+SL) THEN 560
179 REM FLAGS TO START SEARCHES,
    CHANGE PLAYERS - DISPLAY
    NEW SCORES
180 IF F=-1 AND B=3 GOSUB150 ELS
E IF F=-1 AND B=4 GOSUB160
190 IF F=1 THEN IF B=3 THEN B=4
ELSE B=3
200 F=1:PAINT(116,8),B,1:SOUND20
0,5:IF ST=100 GOTO790
209 REM JOYSTICK INPUT
210 RH=INT(JOYSTK(0)/3)*8+40:RV=
INT(JOYSTK(1)/3)*8+12:RP=PEEK(65
280)
220 LH=INT(JOYSTK(2)/3)*8+40:LV=
INT(JOYSTK(3)/3)*8+12:LP=PEEK(65
280)
230 IF B=3 THEN H=RH:V=RV:FP=RP:
IF FP=125 OR FP=253 THEN FP=255:
GOTO250 ELSE GOTO250
240 H=LH:V=LV:FP=LP:IF FP=126 OR
 FP=254 THEN FP=255
249 REM SET LOWER LIMIT FOR DOT
250 IF H<48 THEN H=48
260 IF V<20 THEN V=20
269 REM FLASH DOT AND SET TO
   ORIGINAL COLOR BEFORE LEAVING
270 D=PPOINT(H,V):PSET(H,V,2):FO
RX=1TO40:NEXT:PRESET(H,V):FORX=1
```

Q SOFT

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• THE SPIDER •

By: CHROMATIC SOFTWARE". All machine language. Annihilate the spider before he destroys you. Arcade action. Joysticks needed. Reviewed in Jan. 1983 issue of the "RAINBOW" on page 160.

Cassette: 16K $19.95

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48 "CHECKERS" are placed on the two outside rows of a standard checkerboard. Remove as many "checkers" as possible, jumping diagonally. Play with or without joysticks. HI-RES graphics.

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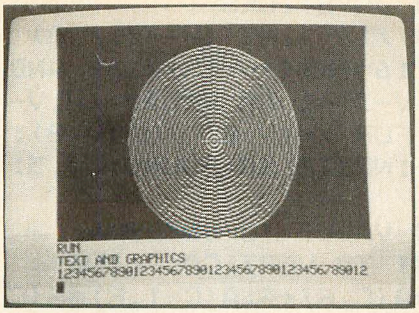
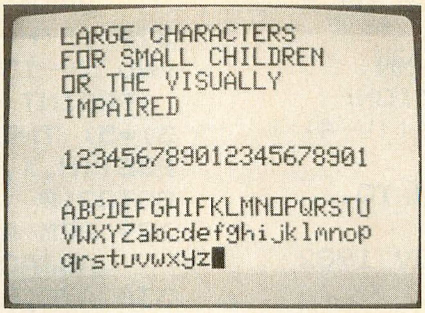


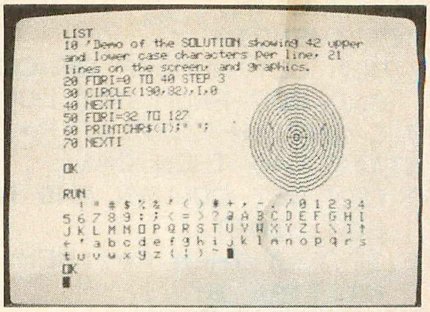
```
RUN
TEXT AND GRAPHICS
123456789012345678901234567890123456789012
█
```



```
LARGE CHARACTERS
FOR SMALL CHILDREN
OR THE VISUALLY
IMPAIRED

123456789012345678901

ABCDEFGHIFKLMNOPQRSTU
VWXYZabcdefghijklmnop
qrstuvwxyz█
```



```
LIST
10 'Demo of the SOLUTION showing 42 upper
and lower case characters per line, 21
lines on the screen, and graphics.
20 FORI=0 TO 40 STEP 3
30 CIRCLE(190,82),I,0
40 NEXTI
50 FORI=32 TO 127
60 PRINTCHR$(I);" ";
70 NEXTI

OK

RUN
 ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4
5 6 7 8 9 : ; < = > ? @ A B C D E F G H I
J K L M N O P Q R S T U V W X Y Z [ \ ] ↑
← ' a b c d e f g h i j k l m n o p q r s
t u v w x y z { | } ~ █
OK
█
```

SOLUTION ON CARTRIDGE

The cartridge version of **THE SOLUTION** has all of the features of the tape version and more. It works with all of the graphic modes (including 4 colors). It includes a 51 characters per line feature and the ability to define a text window on the screen. All of this and much more at the low price of — **$34.95**

ROM-PAKS ~~$9.95~~ **$ 7.50**

This is an empty Rom-Pak with a PC board. It will hold either a 2716, 2732 or a 2764. The case looks very similar to Radio Shack's Rom-Pak. Comes complete with instructions.

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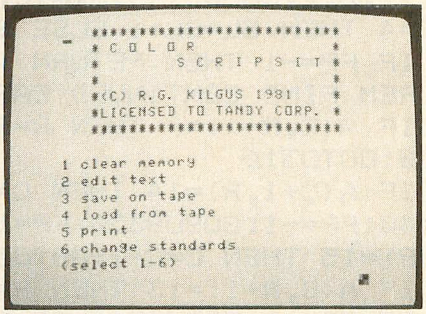
We will put your program in a Rom-Pak for you for a very reasonable fee. The program can be either Basic or machine language. Prices start at $19.95 for programs up to 4K in length. $29.95 for programs up to 8K. **Volume discounts** are available. Send for a **free submittal form.**



```
-   ****************************
    * C O L O R                *
    *         S C R I P S I T  *
    *                          *
    *(C) R.G. KILGUS 1981      *
    *LICENSED TO TANDY CORP.   *
    ****************************

1 clear memory
2 edit text
3 save on tape
4 load from tape
5 print
6 change standards
(select 1-6)
                              █
```

SCRIPTFX ~~$9.95~~ **$ 4.95**

Are you tired of the upper case display of Color Scripsit? Well then **SCRIPTFX** is for you. This is a program which converts the display of Color Scripsit over to a real display of upper and lower case letters with descenders. The program allows all of the features of Scripsit to function and comes with a money back guarantee if it does not work. Please specify machine type when ordering. Extended Basic is not required.

SUPER PILOT ~~$9.95~~ **$ 7.95**

An enhanced version of Pilot for use with Extended Basic. Includes features for math, graphics, and sound. Has a feature that makes it easy to create flash card type drill programs. Programs are pseudo compiled for faster execution. Comes with as 24 page tutorial manual and demo programs. Sample program included on tape to get you started.

All programs for 16K, 32K Extended Basic machines unless otherwise noted. All programs on cassette. Add $4.00 per order for disk.

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- provides a screen of **42 characters** by **21** lines displayed
- linked directly to basic — program is transparent to the user
- prints all 96 ASCII characters, lowercase characters have descenders, has a slashed **zero** to avoid confusion when programing
- prints characters on any two-color graphic screen
- graphics and text may be intermixed on the same screen
- special mode with 4 lines of text at the bottom of the screen (just like some other famous color machines) — great for working with graphics
- large character mode for small children or the visually impaired
- character set may be reversed
- written in machine language, program is relocatable
- fast — prints at over 600 characters per second
- works with both cassette and disk
- includes a 20 page manual with demo programs (a lunar lander program is included)

SOLUTION ~~$19.95~~ **$14.95**

EXTENDER $** ~~7.95~~ **$ 4.95

Still want more than 42 characters per line from your computer. Then the **EXTENDER** is for you. This program when used with **THE SOLUTION** will give a display of **51** characters per line by 21 lines displayed. Please include your program serial number when ordering.

GRAPH LABEL ~~$8.95~~ **$ 5.95**

Have you ever wanted to place characters on a graphic screen but couldn't find an easy way to do it. Well then **GRAPH LABEL** is for you. This program will enable you to place characters anywhere on a graphic screen. It will place any of 96 ASCII characters on the screen or you may create your own characters. It features a cursor that may be moved anywhere around the screen with out rubbing out what it goes over. Superscripts and subscripts may be used since the cursor may be moved vertically and horizontally in steps as small as one pixel. Lowercase characters have descenders. **GRAPH LABEL** is written in Basic and is therefore easy to modify. It may be used by itself or as a subroutine.

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2) **DOUBLE SIZE SCREEN PRINT** — this program will produce a full size image that will fill up a sheet of paper. The finished product is 8 by 6.5 inches in size. Your computer graphics look really good when they are printed out with this program.

SHIPPING — add $2.00 for orders less than $20.00. Shipping is **free** on orders of more than $20.00.
Canadians — please send money orders only.

All orders shipped within 5 working days.

```
TO30:NEXT:PSET(H,V,B):FORX=1TO50
:NEXT:PSET(H,V,D):IF FP=255 OR F
P=127 THEN210
279 REM GET NUMBER OF COLUMN
    AND ROW FROM DOT LOCATION
280 C=INT((H-32)/16):R=INT((V-4)
/16):IF C=0 THEN C=1
289 REM SET COLUMN AND ROW TO
    LOW LIMIT
290 IF R=0 THEN R=1:REM NOV 1982
    WRITTEN BY
    DANIEL W. PHILLIPS
    289 S. SHERIDAN ST.
    WILKES-BARRE, PA.18702
299 REM CHECK FOR LEGAL MOVE
    IN HORIZONTAL -IF NO LEGAL
    MOVE CHECK VERTICAL
300 IF(H-40)/16=INT((H-40)/16) A
ND (V-12)/16<>INT((V-12)/16) AND
 (PPOINT(H-3,V)=1 OR PPOINT(H-3,
V)=5) THEN FORX=(H-8) TO (H+8):P
SET(X,V,2):NEXT:ELSE GOTO320
309 REM ADD VALUE TO BOXES
    ADJACENT TO HORIZONTAL LINE
310 A(C,R)=A(C,R)+8:A(C,R-1)=A(C
,R-1)+2:IF FP=-1 THEN RETURN ELS
E GOTO340
319 REM CHECK FOR LEGAL MOVE
    IN VERTICAL - IF NO LEGAL
    MOVE, MAKE NOISE AND GO
    BACK TO JOYSTICKS
320 IF(H-40)/16<>INT((H-40)/16)
AND (V-12)/16=INT((V-12)/16) AND
 (PPOINT(H,V-3)=1 OR PPOINT(H,V-
3)=5) THEN FOR X=(V-8) TO (V+8):
PSET(H,X,2):NEXTELSE SOUND100,5:
GOTO210
329 REM ADD VALUE TO BOXES
    ADJACENT TO VERTICAL LINE
330 A(C,R)=A(C,R)+4:A(C-1,R)=A(C
-1,R)+1:IF FP=-1 THEN RETURN
339 REM CHECK THE ONLY THREE
    BOXES THAT COULD BE CAPTURED
340 IF A(C,R)=15 GOTO380
350 IF A(C,R-1)=15 THEN R=R-1:GO
TO380
360 IF A(C-1,R)=15 THEN C=C-1:GO
TO380
369 REM NO CAPTURES
370 GOTO180
379 REM COLOR BOX WITH PLAYERS'
    COLOR - PROTECT BOX FROM
    BEING REUSED - ADD ONE TO
    SCORE
380 X=(C*16)+40:Y=(R*16)+12:PAIN
T(X,Y),B,2:SOUND144,3:A(C,R)=16:
IF B=4 THEN SL=SL+1 ELSE SR=SR+1
390 IF FP=-1 THEN RETURN
399 REM FIND CONTINUED CAPTURES
400 IF A(C,R-1)=7 THEN R=R-1:GOS
UB130:GOTO310
410 IF A(C+1,R)=14 THEN C=C+2:GO
SUB140:FP=-1:GOSUB330:FP=1:IF A(
C-1,R)=15 THEN C=C-1:GOTO380
420 IF A(C,R+1)=13 THEN R=R+2:GO
SUB130:FP=-1:GOSUB310:FP=1:IF A(
C,R-1)=15 THEN R=R-1:GOTO380
430 IF A(C-1,R)=11 THEN C=C-1:GO
SUB140:GOTO330
440 IF A(C,R-1)=11THEN R=R-1:GOS
UB140:GOTO330
450 IF A(C,R-1)=14 THEN C=C+1:R=
R-1:GOSUB140:GOTO330
460 IF A(C+1,R)=7 THEN C=C+1:GOS
UB130:GOTO310
470 IF A(C+1,R)=13 THEN R=R+1:C=
C+1:GOSUB130:GOTO310
480 IF A(C,R+1)=11 THEN R=R+1:GO
SUB140:GOTO330
490 IF A(C,R+1)=14 THEN C=C+1:R=
R+1:GOSUB140:GOTO330
500 IF A(C-1,R)=7 THEN C=C-1:GOS
UB130:GOTO310
510 IF A(C-1,R)=13 THEN C=C-1:R=
R+1:GOSUB130:GOTO310
520 IF A(C,R-1)=15 THEN R=R-1:GO
TO380
530 IF A(C+1,R)=15 THEN C=C+1:GO
```

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Features include:

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- Enter text or formulas to 255 characters long
- Repeat text entries
- 255 maximum rows
- 255 maximum columns
- Available memory always displayed
- Rapid Entry modes for text and data
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- Insert, Delete, Move entire rows or columns
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- All machine language for speed
- Extended BASIC required for ROM routine calls
- Automatic memory size detection for 16K, 32K or 64K
- >20K bytes, storage available in 32K systems
- BASIC style formulas
- Math Operators: +,−,X,/,↑,(,),=
- Relation Operators: =,>,<,<=,>=,<>
- Logic Operations: AND, OR, NOT
- Conditional Formula: IF . . . THEN . . . ELSE
- Trig Functions: SIN, COS, TAN, ATN

★ Easy to use

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- Adjustable row height to insert blank lines without wasting memory
- Hide colmns or rows
- Alternate print font selectable on cell by cell basis
- Display/Print formats set by cell, row, or column
- Dollar format, comma grouping; prefix or postfix sign
- Scientific notation, fixed point and integer formats
- Left and Right cell contents justification
- Full page formatting
- All formats stored with worksheet on disk(tape)
- Save & Load Disk(tape) files in compact memory form
- Scan disk directories
- Output ASCII file for word processor input compatibility
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Sample worksheets included

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```
TO380
540 IF A(C,R+1)=15 THEN R=R+1:GO
TO380
550 IF A(C-1,R)=15 THEN C=C-1:GO
TO380
559 REM SET FLAGS TO GIVE THE
    CURRENT PLAYER ANOTHER TURN
560 ST=(SR+SL):F=-1
569 REM SEARCH OF ENTIRE BOARD
570 FOR Y=1TO10:FOR X=1TO10
580 IF A(X,Y)=16 THEN NEXT X,Y:G
OTO170
590 IF A(X,Y)=7 THEN C=X:R=Y:GOS
UB130:GOTO310
600 IF A(X,Y)=14 THEN C=X+1:R=Y:
GOSUB140:GOTO330
610 IF A(X,Y)=13 THEN C=X:R=Y+1:
GOSUB130:GOTO310
620 IF A(X,Y)=11 THEN C=X:R=Y:GO
SUB140:GOTO330
630 IF A(X,Y)=15 THEN C=X:R=Y:FP
=-1:GOSUB380:FP=1:X=C:Y=R
640 NEXT X,Y:GOTO170
649 REM PUT RANDOM LINES ON THE
    BOARD
650 Y=RND(10):X=RND(10)
660 FOR R=Y TO11:FOR C=X TO11:IF
 R=11 AND C=11 THEN NEXTC,R:X=1:
Y=1:GOTO660
670 IF A(C,R)=0 AND A(C,R-1)=0 A
ND A(C-1,R)=0 THEN IF C=>R GOTO7
10 ELSE GOTO720
680 IF A(C,R)=0 THEN LP=A(C,R-1)
:LP=LP+1:ON LP GOTO 710,710,690,
690,710,700,690,700,710,700,690,
700,700
690 IF A(C,R)=8 THEN LP=A(C-1,R)
:LP=LP+1:ON LP GOTO 720,700,720,
700,720,700,700,700,720,700,700,
700,700
700 NEXTC,R:X=1:Y=1:GOTO660
710 IF C=11 THEN 715 ELSE GOSUB1
30:GOSUB310:GOTO730
714 REM SPECIAL CASE * VERTICAL
    LINE FOR RIGHT SIDE OF BOARD
715 LP=A(C-1,R):IFLP=2 OR LP=4 O
R LP=8 THEN 720 ELSE 700
720 IF R=11 THEN 700 ELSE GOSUB1
40:GOSUB330
730 D=D+1:SOUND D,1:IF D=60 THEN
 RETURN ELSE 650
739 REM PRINT INSTRUCTIONS
740 CLS:PRINT@46,"DOT":PRINT" TH
E OBJECT OF THE GAME IS TO   CO
NNECT THE DOTS TO FORM AS    MA
NY BOXES AS POSSIBLE WITHOUT  LE
TTING YOUR OPPONENT CAPTURE   AN
Y BOXES. THE PLAYER WHO COM-  PL
ETES A BOX CAPTURES THAT BOX.";
750 PRINT" THE COMPUTER WILL THE
N SEARCH   FOR ADDITIONAL CAPTUR
ES. EACH   BOX COUNTS FOR ONE PO
INT.       WHEN ALL CAPTURES ARE
 MADE FOR  A TURN, THE SCORE IS
UPDATED,   AND THE PLAYER WILL D
RAW ONE    MORE LINE.":PRINT@483
,"PRESS ANY KEY TO CONTIN
760 N$=INKEY$:IF N$=""THEN760 EL
SE CLS
770 PRINT@35,"A TONE WILL SOUND
WHEN...":PRINT@97,"A- AN ILLEGAL
 MOVE IS ATTEMPTED B- THE DOT IS
 BACK ON THE BOARD    AFTER A SE
ARCH               C- AS EACH CA
PTURED BOX IS         FILLED WIT
H THE PLAYERS         COLOR":PRI
NT@489,"PRESS ANY KEY";
780 N$=INKEY$:IF N$=""THEN 780 E
LSE PRINT@489,STRING$(13,CHR$(32
));:RETURN
789 REM SHOW BOARD AFTER FINAL
    CAPTURE - THEN PLAY AGAIN
    OR QUIT
790 FOR X=1TO2500:NEXTX:CLS:PRIN
T@205,"DOTS":PRINT@451,"FOR ANOT
HER GAME PRESS 'A'        TO END
 PRESS ANY KEY"
800 N$=INKEY$:IF N$=""THEN 800EL
SE IF N$="A" THEN RUN:ELSE END
```

SOFTWARE-HARDWARE

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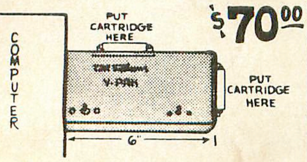

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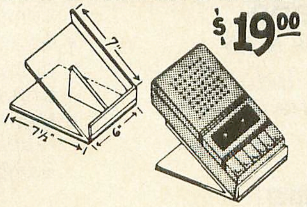

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Telewriter-64™

the Color Computer Word Processor

- **3 display formats: 51/64/85 columns × 24 lines**
- **True lower case characters**
- **User-friendly full-screen editor**
- **Right justification**
- **Easy hyphenation**
- **Drives any printer**
- **Embedded format and control codes**
- **Runs in 16K, 32K, or 64K**
- **Menu-driven disk and cassette I/O**
- **No hardware modifications required**

THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

> *...one of the best programs for the Color Computer I have seen...*
> — Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

RAINBOW
CERTIFICATION
SEAL

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

> *...truly a state of the art word processor... outstanding in every respect.*
> — The RAINBOW, Jan. 1982

PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.

Telewriter-64 costs $49.95 on cassette, $59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)

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RAINBOW

Give us your best: Join the ranks of these courageous CoCoists in showing the Color Computer world your high score at your favorite micro-diversion. We want to put your best effort on record in *the Rainbow's* Scoreboard column. All entries must be received by the first of the month to be eligible for the following month's Scoreboard.

★ **New Number One** ☆ **Last Month's Number One**

SCORE		PLAYER
ASTRO BLAST		
158,000	★	Larry Plaxton, Medley, Alberta
92,000	☆	Harry Sawyer, Watchung, NJ
79,914		Jim Baker, Florissant, MO
75,314		Mike Hall, Hartland, WI
71,000		Emil Hayek, State College, PA
64,000		Robert R. Franks, Jr.,Toledo, OH
63,025		Russell Wronski, Palatine, IL
AVENGER		
14,075	★	Stephen Lai, Palatine, IL
11,560	☆	Peter Niessen, Carlisle, MA
5,345		Craig Schubert, Newfoundland, NJ
5,000		Cameron Amick, Reisterstown, MD
BERSERK		
22,050	★	Jim Baker, Florissant, MO
10,250	☆	Mike Anheluk, Fall Creek, OR
10,070		Harry Sawyer, Watchung, NJ
7,800		Mike Hall, Harland, WI
6,150		Steve Skrzyniarz, Tacoma, WA
BUSTOUT		
34,700	★	Sara Hennessey, Golden Valley, MN
28,720		Perry Denton, New Baden, IL
25,510	☆	Andy Klingler, San Diego, CA
5,942		Norbert Berenyi, Northvale, NJ
CANYON CLIMBER		
23,400	★	Craig M. Arnold, Dallas, TX
CATCH 'EM		
91,000	☆	Dean Bouchard, Kingston, Nova Scotia
65,768		Laura Sandman, Louisville, KY
CATERPILLAR		
30,029	★	Ron Rhead, Willowdale, Ontario
CAVE HUNTER		
42,600	☆	Gary Ritchie, Bellevue, Alberta
26,300		Mike Hughey, King George, VA
21,150		Jim Baker, Florissant, MO
CLOWNS & BALLOONS		
65,050	★	Brian Gould, Basking Ridge, NJ
61,700	☆	Dan Dowling, San Bruno, CA
46,930		Stephen Shotts, Blacksburg, VA
42,430		Joanne Ledson, North Bay, Ontario
25,450		Norbert Berenyi, Northvale, NJ
22,700		Shelley Partridge, Warkworth, Ontario
COLOR HAYWIRE		
14,650	★	Todd C. Hauschildt, Red Wing, MN
14,350		Mike Hughey, King George, VA
10,900		John Cole, King City, Ontario
10,450		Brian Austin, Rotterdam, NY
10,250	☆	Pat Downard, Louisville, KY
COLOR INVADERS		
166,425	★	Jim Baker, Florissant, MO
126,350		Perry Denton, New Baden, IL
101,240		Larry Plaxton, Medley, Alberta
83,000	☆	Cameron Amick, Reisterstown, MD
COLOR METEOROIDS		
252,050	★	Larry Plaxton, Medley, Alberta
206,000		Peter Johnson, Chino, CA
197,400		John Scannell, Renton, WA
153,000		Steve Lewallen, Centerville, OH
149,000	☆	Cameron Amick, Reisterstown, MD
COLOR SCARFMAN		
976,520	★	Bruce Thornhill, Barrhead, Alberta
539,100		Larry Plaxton, Medley, Alberta
523,340		Fred K. Herrman, Flemington, NJ
506,560	☆	Russ Eubanks, Jay, ME
488,730		Del Alexander, San Antonio, TX
417,740		Danny Eldridge, Fair Oaks, CA
401,990		Cynthia Eldridge, Fair Oaks, CA
COLORPEDE		
2,139,248	★	Mike Hall, Hartland, WI
2,005,227	☆	Jennifer Maxey, Kalamazoo, MI
1,329,868		Russ Eubanks, Jay, ME
1,104,029		Gary Ritchie,Bellevue, Alberta
684,117		David Blyn, Staten Island, NY
539,941		Brian Hsu, Holmdel, NJ
469,142		Michael Rader, Hardtner, KS
386,506		Robert Rahmes, Silver Spring, MD
323,946		Herbert Ponder, Jacksonville, FL
317,361		Lyman Green, Jr., Ballouville, CT
287,341		Robert Denton, New Baden, IL
206,558		Kim A. Cook, High Point, NC
173,904		Andrew Herron, High Point, NC
COLOR ZAP		
227,330	★	Ron Rhead, Willowdale, Ontario
COLOUR PAC ATTACK		
472,465	★	Jim Baker, Florissant, MO
193,000	☆	Cameron Amick, Reisterstown, MD
51,150		Emil Hayek, State College, PA
27,500		David Rosicky, Pittsburgh, PA
CONQUEST OF KZIRGLA		
10,399	☆	Scott Sehlhorst, Columbia, SC
DEFENSE		
58,900	☆	Greg Scott, Orlando, FL
DOODLE BUG		
825,000	★	John Cole, King City, Ontario
355,440		Bette Munitz, Bellerose, NY
343,000		Mike Hughey, King George, VA
338,590		Joanne Ledson, North Bay, Ontario
294,930		Stephen Lai, Palatine, IL
260,000		Jeff Pyne, Port Mouton, Nova Scotia
45,580		Mrs. Sandy Nierste, Clio, MI
DOUBLEBACK		
89,840	★	Craig M. Arnold, Dallas, TX
50,110	☆	Mary H. Thomas, Louisville, KY
43,660		Ron Moore, Wellsville, OH
27,680		Andrea L. Herron, High Point, NC
DUNKEY MUNKEY		
1,618,800	★	Bryan Bloodworth, Federal Way, WA
1,099,400	☆	Andrew Herron, High Point, NC
1,000,500		Wendy Johnson, San Jose, CA
1,000,001		Grant Gillott, Calgary, Alberta
626,400		Peter Niessen, Carlisle, MA
508,000		Robert Denton, New Baden, IL
333,300		Rob Uriano, Framingham, MA
308,000		Mitch Cohen, Framingham, MA
THE FROG		
15,400	★	Debbie Purdy, Dearborn, MI
FROG TREK		
10,370	★	Jim Baker, Florissant, MO
7,160	☆	Mike Anheluk, Fall Creek, OR
GALACTIC ATTACK		
54,200	★	Mike Hughey, King George, VA
48,320		John Cole, King City, Ontario
43,010		Brian Austin, Rotterdam, NY
39,140		Greg Onlofsky, Ridgefield Park, NY
25,210		John & Krista McCallum, Woodburn, OR
23,600		John McCallum, Woodburn, OR
22,240		Daniel Milbrath, Ann Arbor, MI
21,260		Brian Caulley, Reynoldsburg, OH
18,120		Lenny Munitz, Bellerose, NY
17,310		Tyler Bolen, Wheaton, IL
16,660		Jeff Willard, Chireno, TX
GALAX ATTAX		
46,450	★	Robert Rahmes, Silver Spring, MD
33,350		Aaron Cundiff, Livermore, KY
33,000		Todd Zuehl, Livermore, KY
30,350		Mark Raphael, Englishtown, NJ
GHOST GOBBLER		
825,250	☆	Randy Gerber, Wilmette, IL
103,590		Harry Sawyer, Watchung, NJ
58,270		Mike Hall, Hartland, WI
49,880		Steven Picone, Leomister, MA
INVADERS REVENGE		
32,600	☆	Harry Sawyer, Watchung, NJ
INVASION		
82,000	☆	Harry Sawyer, Watchung, NJ
KATERPILLAR ATTACK		
14,375	★	Norbert Berenyi, Northvale, NJ
12,703	☆	Warren Schubert, Newfoundland, NJ
12,544		Todd C. Hauschildt, Red Wing, MN
12,100		Peter Stumpfi, McHenry, IL
9,137		Ron Rhead, Willowdale, Ontario
THE KING		
1,858,000	★	Mike Hughey, King George, VA
1,000,000		Debbie Purdy, Dearborn, MI
805,700	☆	Dave Mercer, Marissa, IL
486,500		Frank Bottino, St. Louis, MO
448,900		Alan Mack, Penn Yan, NY
388,500		Carl Castillo, Yorktown Heights, NY
332,100		Candy Harden, Birmingham, AL
319,500		Ben Lattin, Cosmopolis, WA
239,100		Perry Denton, New Baden, IL
238,100		Bill Schultz, High Bridge, NJ
231,400		Tom Schultz, High Bridge, NJ
167,200		James Whitt, San Antonio, TX
131,200		John Ottesen, E. Hanover, NJ
118,800		Brian Rugges, Dayton, OH
110,000		Robert R.Franks, Jr., Toledo, OH
KOSMIC KAMIKAZE		
49,900	☆	Mark Raphael, Englishtown, NJ
MEGA-BUG		
13,783	★	Donald Habben, Morrison, IL
12,236	☆	Claude Malepart, Montreal, Quebec
11,886		John Tiffany, Washington, D.C.
10,628		John Yapp, Park Forest, IL
10,250		Benjy Nicholls, Lincoln, NE
9,049		Sheri Louis, Streator, IL
9,019		Scott Little, Somers, IA
8,535		Pete McCallum, Woodburn, OR
8,313		Chizuru Gannon, Eilson AFB, AK
7,973		Christine Hoff, Decatur, IL
5,991		Shizuka Gannon, Eilson AFB, AK

SCOREBOARD

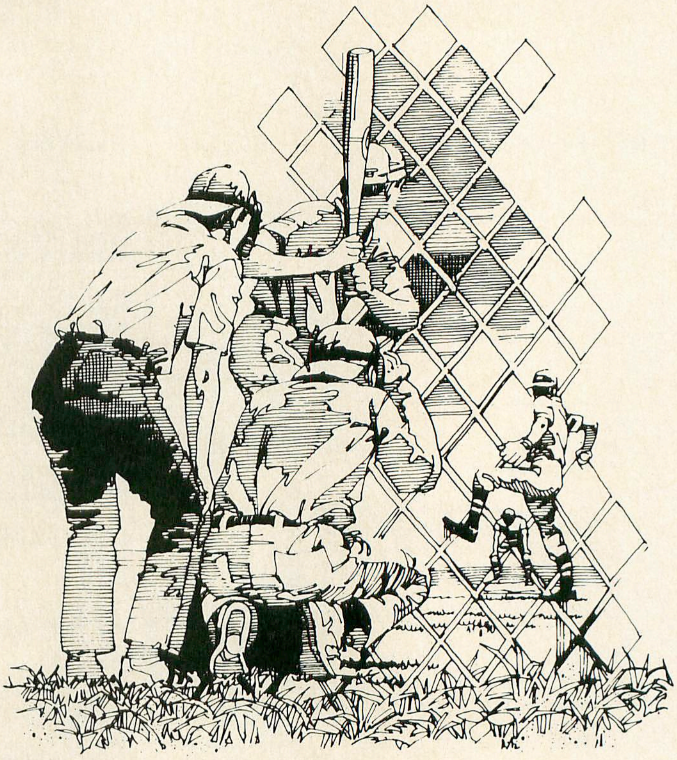
SCORE	PLAYER
METEORS	
17,810 ★	Lenny Munitz, Bellerose, NY
MICROBES	
259,700 ☆	Sheila Coleman, Griffin, GA
88,120	Kevin Little, Somers, IA
80,400	Ken Miller, Yardley, PA
63,570	Greg Scott & Greg Shields, Orlando, FL
59,330	Cathie Habben, Morrison, IL
44,750	Daniel Milbrath, Ann Arbor, MI
MR. MUNCH	
24,680 ☆	Alan Mack, Penn Yan, NY
MONKEY KONG	
1,028 ★	Larry Plaxton, Medley, Alberta
963 ☆	Mark Dowling, San Bruno, CA
MONSTER MAZE	
60,000 ★	Brian Austin, Rotterdam, NY
53,130	Michael Partridge, Warkworth, Ontario
30,000 ☆	Claude Malepart, Montreal, Quebec
9,590	John Tiffany, Washington, D.C.
NIBBLER	
14,910 ★	Christal Glovinsky, Staten Island, NY
OFFENDER	
965,400 ★	Jim Baker, Florissant, MO
PAC ATTACK	
88,450 ★	Matthew Brenengen, Lake Elmo, MN
31,635	Tyler Bolen, Wheaton, IL
30,650 ☆	Peter Niessen, Carlisle,MA
PAC-DROIDS	
577,140 ★	Richard Cochrane, Wayne, NJ
140,300	John Yapp, Park Forest, IL
48,640 ☆	Murray Schechter, New York, NY
47,000	Robert M. Russo, Marriotsville, MD
41,380	Benjy Nicholls, Lincoln, NE
38,060	Percy Butler, Canton, ME
36,900	Jack Rains, Montreal, Quebec
36,000	Wayne G. Perry, Charlottesville, VA
29,500	Richard D. Gordley, Castleton, IL
PACET-MAN	
5,000 ☆	Cameron Amick, Reisterstown, MD
3,392 ★	Norbert Berenyi, Northvale, NJ
PHANTOM SLAYER	
180 ☆	Mike Hall, Hartland, WI
PINBALL	
66,650 ☆	Ken Miller, Yardley, PA
PLANET INVASION	
286,075	Larry Plaxton, Medley, Alberta
257,900	Ron Rhead, Willowdale, Ontario
221,350	John Cole, King City, Ontario
207,150	Mike Hughey, King George, VA
74,350	Benjy Nicholls, Lincoln, NE
69,500	Jeff Pyne, Port Mouton, Nova Scotia
68,650	Robert Rahmes, Silver Spring, MD

SCORE	PLAYER
POLARIS	
151,154 ★	Brian Austin, Rotterdam, NY
101,000 ☆	James Quadarella, Brooklyn, NY
98,500	John Cole, King City, Ontario
59,522	John Yapp, Park Forest, IL
57,500	Scott Little, Somers, IA
49,737	Mike Hall, Hartland, WI
49,247	Ron Rhead, Willowdale, Ontario
45,541	Brad Behrendt, Vermillion, OH
POLTERGEIST	
4,956 ☆	Mark Dowling, San Bruno, CA
4,745	Bette Munitz, Bellerose, NY
4,455	Ken Miller, Yardley, PA
POPCORN	
110,570 ☆	Cameron Amick, Reisterstown, MD
56,000	James Quadarella, Brooklyn, NY
PROTECTORS	
358,514 ☆	Cameron Amick, Reisterstown, MD
154,967	Frankie Jimenez, Mesa, AZ
94,000	Gerry Schechter, Yonkers, NY
RAIL RUNNER	
38,360 ★	Jim Baker, Florissant, MO
13,195	Lenny Munitz, Bellerose, NY
ROBOTTACK	
1,197,800 ★	Brian Austin, Rotterdam, NY
939,300	Robert Kiser, Monticello, MS
702,200	Stephen Lai, Palatine, IL
527,700	Richard Slapp, Lake Elmo,MN
523,010	Steve Lewallen, Centerville, OH
358,300	Emil Hayek, State College, PA
255,800	Sam Heitz, Chicago, IL
213,870	Carol Wierzba, Southgate, MI
SHOOTING GALLERY	
28,500 ★	Kenneth Partridge, Warkworth, Ontario
16,370	Saul Munitz, Bellerose, NY
SHUTTLE SIMULATOR	
565 ☆	John W. Fraysse, Dahlgren, VA
SKIING	
40.10 ★	Fred K. Herrmann, Flemington, NJ
49.43	John Scanlan, Prairie Village, KS
52.22	Peter Johnson, Chino, CA
1:12.11	Benjy Nicholls, Lincoln, NE
1:13.13	Norbert Berenyi, Northvale, NJ
1:13.17	Donald Habben, Morrison, IL
1:13.40	Daniel Milbrath, Ann Arbor, MI
SKY DEFENSE	
6,700 ☆	Mike Anheluk, Fall Creek, OR
6,120	Steve Skrzyniarz, Tacoma, WA
5,200	Cameron Amick, Reisterstown, MD
SOLO POOL	
103 ☆	John W. Fraysse, Dahlgren, VA

SCORE	PLAYER
SPACE ASSAULT	
238,580 ★	John Cole, King City, Ontario
157,140	David Milbrath, Ann Arbor, MI
156,650 ☆	Nathan Miller, Portland, OR
135,080	Brian Austin, Rotterdam, NY
122,230	Robert Lightheart, Ellwood City, PA
105,000	Rodney Garner, Denton, NC
66,870	Fred K. Herrmann, Flemington, NJ
54,280	John Yapp, Park Forest, IL
36,930	Tyler Bolen, Wheaton, IL
33,100	Brian Gould, Basking Ridge, NJ
29,270	Todd Little,Somers, IA
SPACE INVADERS	
62,300 ☆	Peter Niessen, Carlisle, MA
SPACE RACE	
59,825 ★	Jim Baker, Florissant, MO
58,100	John Cole, King City, Ontario
31,525 ☆	Gregg Scott, Orlando, FL
4,000	Danielle Gardner, Louisville, KY
SPACE SHUTTLE	
594 ☆	Steve Schweitzer, Sewell, NJ
511	Larry Reitz, Toledo, OH
SPACE WAR	
400,190 ★	Mark Felps, Bedford, TX
116,000 ☆	Peter Niessen, Carlisle, MA
52,380	Jim Baker, Florissant, MO
STARBASE ATTACK	
21,628 ☆	Mark Raphael, Englishtown, NJ
STARBLASTER	
408,245 ☆	Mark Dowling, San Bruno, CA
325,790	Mike Anheluk, Fall Creek, OR
126,135	Mike Hall, Hartland, WI
80,001	Alan Lewis, Ridgefield, CT
STARFIRE	
2,102,450 ☆	Dean Bouchard, Kingston, Nova Scotia
1,320,150	Joy Bailey, Lexington, NC
1,120,000	Emil Hayek, State College, PA
698,200	Robert E. Courts, Batonia, OH
618,400	Peter Stumpfi, McHenry, IL
563,200	Daniel Milbrath, Ann Arbor, MI
STARSHIP CHAMELEON	
72,600 ★	Jim Baker, Florissant, MO
68,500 ☆	Cameron Amick, Reisterstown, MD
64,800	David Rosicky, Pittsburgh, PA
STORM	
723,335 ☆	Chris Sweet, Harvard, MA
472,320	John Jaworski, Nashua, NH
380,000	Cameron Amick, Reisterstown, MD
240,745	Todd C. Hauschildt, Red Wing, MN
193,965	Mike Hall, Hartland, WI
VENTURER	
2,152,150 ☆	Greg Scott, Orlando, FL
1,769,400	Todd C. Hauschildt, Red Wing, MN
1,526,200	Peter Niessen, Carlisle, MA
803,100	Emil Hayek, State College, PA
344,550	Steve Skrzyniarz, Tacoma, WA
ZAXXON	
401,900 ★	Mike Hughey, King George, VA
81,800 ☆	Matt Cox, Roseville, CA
78,190	Steve Skrzyniarz, Tacoma, WA
74,136	Rod Moore, Wellsville, OH
65,600	Debbie Purdy, Dearborn,MI
57,200	John Scannell, Renton, WA

STATS

By Edward R. Carson



This program was written to assist all of us Little League coaches who have spent hours after each game writing down each players' at bats, hits, runs, etc., trying to figure out all the averages. Well, here is a program to do it for you.

Stats will keep track of at bats, hits, runs, walks, strike outs and batting average. For the pitchers it tracks innings pitched, earned runs, hits, strikeouts, walks and earned run average.

There is space for 15 players. In the pitching program there is space for seven pitchers.

The program is easy to use and the menus are self-explanatory. But, you must input all players' names first or zeros will be entered in place of the name.

As you are entering the statistics, you will hear a warning tone as you go from one set of statistics to the next. I found this helpful as I went through the scorebook with my head down.

On a 16K, ECB, *CLOAD* "STAT" then *PCLEAR* 1 and *RUN.*

I am looking forward to having *Stats* help me this year; I hope it can help you, also.

The listing:

	9100 ... 118E
1020 ... 02B1	9370 ... 1339
3080 ... 0441	9640 ... 14E2
3340 ... 0623	9890 ... 1689
5010 ...07C5	10060 .. 1926
5086 ... 0A27	10215 . 1ACF
7095 ...0C34	10370 ..1C3F
8230 ... 0E0E	10540 . 1DCD
8530 .. 0FFC	END ... 1F65

```
5 CLEAR 1500:CLS
10 :DIM  PL$(20),AB$(20),HT$(20)
,R$(30),K$(20),BB$(20),AV(20)
12 ::
15 'LITTLE LEAGUE STATS
20 'BY ED CARSON,3/15/83
22 :
30 CLS:PRINTTAB(8) "BASEBALL STA
TS"
35 PRINT STRING$(32,"*")
50 PRINT @ 102,"(1)INPUT PLAYERS
"
60 PRINT @134,"(2)ADD TO LIST"
70 PRINT @166,"(3)INPUT STATS"
80 PRINT @198,"(4)PRINT ALL PLAY
ERS"
90 PRINT @230,"(5)PRINT STATS"
100 PRINT@262,"(6)SAVE TO TAPE"
110 PRINT@294,"(7)LOAD FROM TAPE
"
120 PRINT@326,"(8)ADD TO STATS"
121 PRINT@358,"(9)PITCHERS
130 PRINT @427,"WHICH"
135 PRINT@459,"(1-9)"
140 INPUT M
150 IF M<0 OR M>9 THEN 30
160 ON M GOSUB 1000,1055, 3000,4
000,5000,6000,7000,8000,9000
170 GOTO 30
190 :
995 REM:      INPUT PLAYERS
1000 CLS:Y=1
1010 CLS:PRINT @ 8,"INPUT/ADD PL
AYERS"
1020 PRINT @34,"PRESS<ENTER>WHEN
```

(Mr. Carson is a chief operator and instructor for the Tinken Company in Columbus, Ohio. He and his wife, Marilyn, have three sons. Mr. Carson has spent the last 16 years of his spare time coaching baseball, was president of the Centerburg Little League, and is now secretary-treasurer of the Tri-County Babe Ruth league.)

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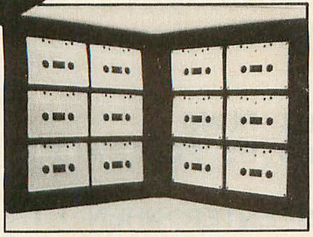

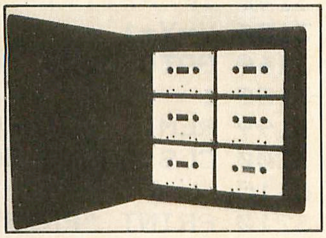

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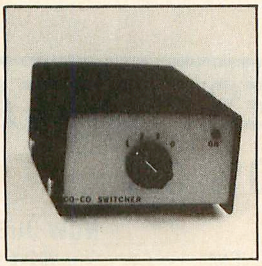

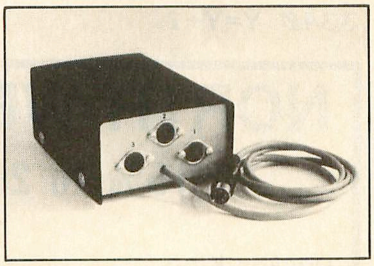

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TAPE FEATURES

Document memory space with 16K: 7424 characters. Memory space with 32K: 23,808 characters. The CoCo-Writer has the same features on either a 16K or 32K system and automatically adjusts to memory upgrade. Load and save files in ASCII or binary format. Load and edit the ASCII files produced by other word processors. Save part or all of a document on tape. Merge tape file into existing document in memory.

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```
FINISHED"
1030 PRINT:PRINT"PLAYER"Y;
1040 INPUT PL$(Y)
1045 IF LEN(PL$(Y))>7 THEN 1046
ELSE 1050
1046 Y=Y:PRINT:PRINT" RE<ENTER>
PLAYERS NAME USE (7)   LETTERS O
NLY"
1047 FORT=1TO920:NEXT T:GOTO1030
1050 IF PL$(Y)=""GOTO 30ELSE 106
0
1055 Y=Y:GOTO 1010
1060 Y=Y+1
1070 GOTO 1030
1080 :
1090 :
2999 REM:    INPUT HITS
3000 CLS:SOUND200,5:FOR Y=1 TO 1
5
3010 PRINT"PRESS<ENTER>WHEN FINI
SHED"
3020 PRINT"ENTER HITS FOR ";PL$(
Y):
3030 INPUT HT$(Y)
3040 IF HT$(Y)="" THEN 3100
3050 Y=Y+1
3060 GOTO 3020
3080 :
3099 REM:    INPUT AT BATS
3100 CLS:SOUND 200,5:FORY=1 TO 1
5
3110 PRINT"PRESS<ENTER>WHEN FINI
SHED"
3120 :PRINT"ENTER AT BATS FOR "P
L$(Y)
3130 INPUT AB$(Y)
3140 IF AB$(Y)=""THEN 3200
3150 Y=Y+1
3160 GOTO 3120
3180 :
3199 REM:     INPUT RUNS
3200 CLS:SOUND 200,5: FOR Y= 1 T
O 15
3210 PRINT "PRESS<ENTER>WHEN FIN
ISHED"
3220 PRINT"ENTER RUNS FOR   " PL$
(Y)
3230 INPUT R$(Y)
3240 IF R$(Y)=""THEN 3300
3250 Y=Y+1
3260 GOTO 3220
3280 :
3299 REM:  INPUT STRIKE OUTS
3300 CLS:SOUND 200,5: FOR Y=1 TO
 15
3310 PRINT"ENTER STRIKE OUTS FOR
 "PL$(Y)
3320 INPUT K$(Y)
3330 IF K$(Y)=""THEN 3400
3340 Y=Y+1
```

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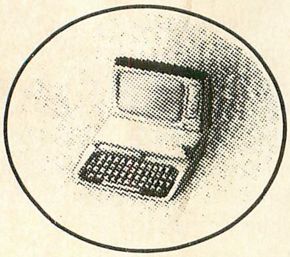

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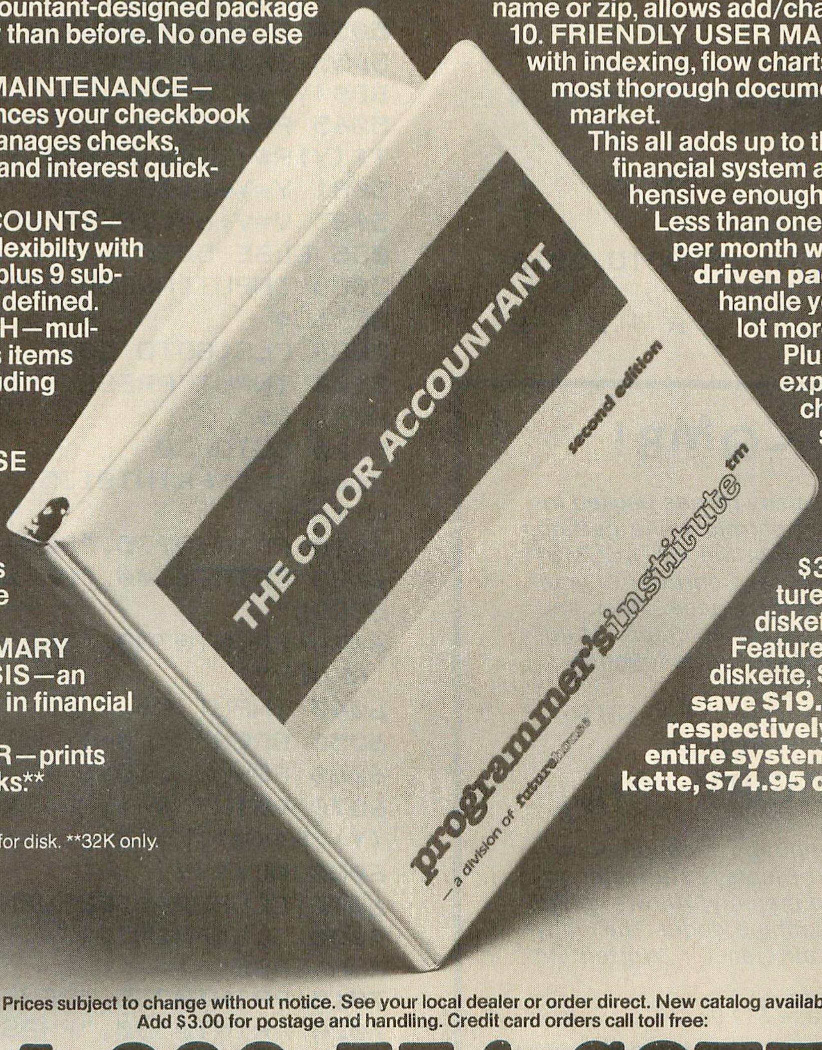

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```
3350 GOTO 3310
3360 :
3399 REM: INPUT WALKS
3400 CLS:SOUND 200,5: FOR Y=1 TO
 15
3410 PRINT"PRESS<ENTER>WHEN FINI
SHED"
3420 PRINT"ENTER WALKS FOR "PL$(
Y)
3430 INPUT BB$(Y)
3440 IF BB$(Y)=""THEN 30
3450 Y=Y+1
3460 GOTO 3420
3570 :
3900 REM   PRINT PLAYERS
4000 FOR X= 1 TO Y -1 STEP 15
4010 FOR Z=X TO X + 14
4020 PRINT Z;PL$(Z)
4030 NEXT Z
4040 NEXT X
4100 INPUT"PRESS<ENTER>TO CONTIN
UE";C$
4110 RETURN
4130 :
4990 REM: PRINT STATS
5000 CLS:FOR Y=1 TO 15:GOTO 5010
5005 Y=Y
5010 V=40:I$="AB   HT    R    K    B
B  AV"
```

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```
5020 PRINT@8,I$
5030 Y=Y:LET HT=VAL(HT$(Y)):LET
AB= VAL(AB$(Y))
5035 IF AB=0 THEN AB=1
5040 AV=HT/AB*1000
5045 F=FIX(AV)
5046 LN=LEN(AB$(Y)):MB=4-LN
5047 IF LEN(AB$(Y))<>4THENAB$(Y)
=AB$(Y)+STRING$(MB," ")
5048 AN=LEN(HT$(Y)):CB=5-AN
5049 IF LEN(HT$(Y))<>5THENHT$(Y)
=HT$(Y)+STRING$(CB," ")
5050 BN=LEN(R$(Y)):DB=4-BN
5051 IF LEN(R$(Y))<4THENR$(Y)=R$
(Y)+STRING$(DB,"  ")ELSE 5052
5052 CN=LEN(K$(Y)):EB=4-CN
5053 IF LEN(K$(Y))<4THENK$(Y)=K$
(Y)+STRING$(EB," ")
5054 EN=LEN(BB$(Y)):DB=3-EN
5055 IF LEN(BB$(Y))<3THENBB$(Y)=
BB$(Y)+STRING$(DB," ")
5065 PRINTPL$(Y):PRINT@V,AB$(Y)H
T$(Y)R$(Y)K$(Y)BB$(Y)F
5081 Y=Y+1:IF Y=16 THEN 5100
5083 V=V+64:IF Y=6OR Y=12 THEN 5
085 ELSE 5030
5085 INPUT"PRESS ENTER TO CONTIN
UE";C$
5086 CLS:GOTO 5005
5100 INPUT"PRESS<ENTER>TO CONTIN
UE"; C$
5110 GOTO 30
6000 CLS:PRINT@135,"SAVE STATS O
N TAPE"
6010 PRINT@235,"REWIND TAPE"
6020 PRINT@300,"PRESS PLAY AND R
ECORD"
6030 PRINT@388,"PRESS<ENTER>WHEN
 READY"
6040 INPUT C$
6050 OPEN"O",#-1,"STATS"
6060 FOR Y=1TO15-1
6070 PRINT #-1,PL$(Y),AB$(Y),HT$
(Y),R$(Y),K$(Y),BB$(Y),F
6080 NEXT Y
6090 CLOSE#-1:RETURN
7000 CLS:PRINT@136,"LOAD STATS F
ROM TAPE"
7010 PRINT@235,"REWIND TAPE"
7020 PRINT@300,"PRESS PLAY"
7030 PRINT@388,"PRESS<ENTER>WHEN
 READY"
7040 INPUT C$
7050 OPEN"I",#-1,"STATS"
7060 Y=1
7070 IF EOF(-1) THEN 7097
7080 INPUT #-1,PL$(Y), AB$(Y),HT
$(Y),R$(Y),K$(Y),BB$(Y),F
7095 Y=Y+1
```

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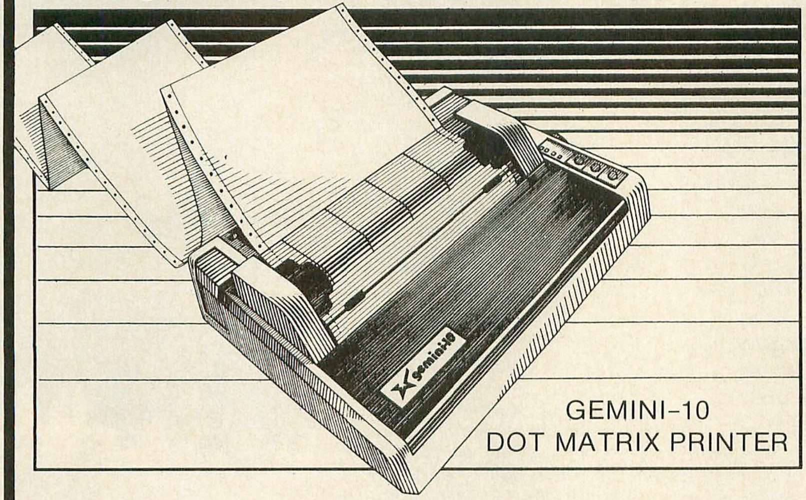

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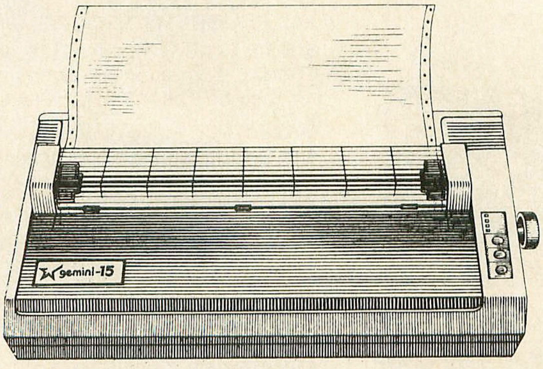

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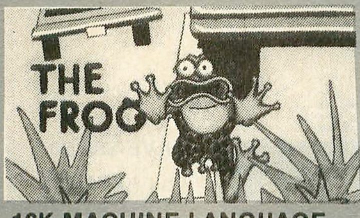

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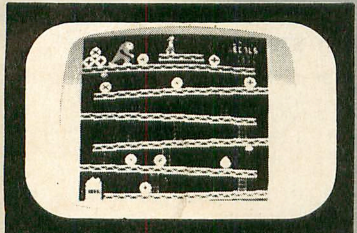

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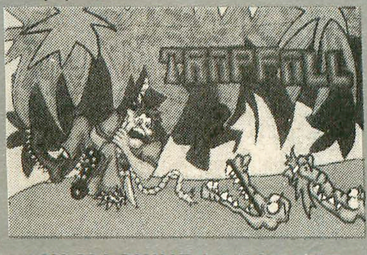

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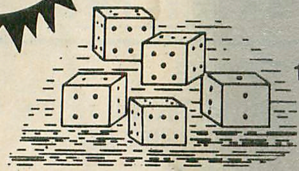
NEW

"YAAZEE"

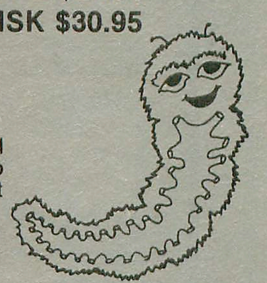
(C) 1983



$19.95
16K MACHINE LANGUAGE
EXT. BASIC

Yaazee is a 2 player game using five dice to get the best poker hand. After game is loaded flashing digit below player number determines which player rolls dice at the start of the game.

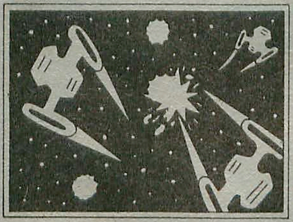
KATERPILLAR ATTACK



Outstanding graphics and sound will end all of those trips to the arcade. So much like the arcade you have to see it to believe it. Requires Ext. Basic.

16K MACHINE LANGUAGE	**$21.95**
DISK	**$24.95**

PROTECTORS



Exciting fast paced arcade game that looks and plays like the popular arcade game "DEFENDER", Wave after wave of enemy fighters drop bombs on your city. Destroy them before they destroy your city. Soon the mother ships appear firing laser blasts at you. Watch for the heat seeking mines.

$24.95 TAPE $27.95 DISK 32K MACHINE CODE

OTHER GREAT GAMES

ALL PROGRAMS REQUIRE 16K

BIRD ATTACK-A fast paced machine language arcade game. Shoot the birdmen before they descend upon you. Watch out for their bombs! **16K Machine Language** **$21.95**

MAZE RACE-Maze race is a one or two player game. Play either against the built in timer or against your favorite opponent. **16K Machine Code** **$17.95**

SOLO POOL-Now play pool with your color computer. Two players. Plays like machine language. Super color. High resolution graphics. **16K Ext. Basic** **$17.95**

ADVENTURES

TREK-16-Travel thru space with Spock and Capt. Kirk. Adventure. Tough! Ext. Basic. **$17.95**

SHIPWRECK-Escape from a desert isle if you can. Great Adventure! Ext. Basic. **$14.95**

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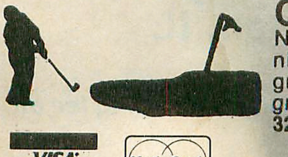

COLOR GOLF

Now sit at your computer and play nine or eighteen holes. Outstanding graphics in the fairway or on the green. Helps your game.
32K EXTENDED BASIC **$17.95**

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•FOR THE COLOR COMPUTER & TDP 100 • 3424 College N.E., Grand Rapids, MI 49505 (616) 364-4791•

UTILITIES

COLOR MONITOR-Written in position independent code. (May be located in any free memory). Very compact. Only occupies 1174 bytes of memory. Full Featured. Includes Break-Pointing of machine language programs, register display and modify, memory display and modify, and block memory move commands. Displays memory in hex and ascii format on one line 8 bytes long. **MACHINE LANGUAGE $24.95**

ROM-This program is a utility that will move "most" 8K Rom-Packs to disk and allow you to run them from disk. Easy to use. Requires 64K. **$17.95**

SCREEN PRINT ROUTINE-Using your Epson or Microline Printer. Print the screen contents on a full size 8½ x 11 sheet. 16K Ext. Basic **$17.95**

TAPE DUPE Now — an all new Tape Backup Program. Even copies those hard to copy Auto-Execute Programs. Protect your software by making a backup copy. Probably the finest tape copier program ever. 16K Maching Language. **TAPE $21.95**
DISK $25.95

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TAPE TO DISK - Load the contents of most tapes to disk automatically. Machine Language. **$17.95**

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THE FIXER-Having trouble moving those 600 Hex progams to disk? The fixer will help. Completely automatic. **$17.95**

TAPE CAT-All new machine language program lists contents of tapes to printer. Make a catalog of your tapes. **$17.95**

PROGRAM PRINTER UTILITY-This program will list basic programs to your printer in two column format. Saves paper and makes your listing look professional. Disk based. **$17.95**

NEW

EDUCATIONAL SOFTWARE For The Color Computer and TDP 100

STORY PROBLEMS is a program that is designed to give practice in solving STORY PROBLEMS (sometimes called STATEMENT, THOUGHT or WORD PROBLEMS) on the COLOR COMPUTER. It is suitable for use in either a home or school environment. It is also a tool that will allow you to create new story problems to suit your children's needs and ability levels. It has many features that make it particularly attractive: Story problems involving addition, subtraction, multiplication, division or a combination of the four are presented to the student by slowly scrolling each letter of each problem onto the screen. Up to 5 students may use the program at the same time. There are 4, user modifiabale, skill levels. 16K Ext. Basic **TAPE $19.95**

CLOCK-With the ever increasing use of digital clocks, more and more young people are unpracticed in the use of the "ANALOG" clocks. You remember those, the ones with the hands. This program will attempt to teach the relationship between the two types of clocks.
REQUIRES 16K EXT. BASIC $14.95

SPELLING TEST is designed to give a standard oral spelling test using the audio track of the computer's tape recorder to dictate test words and sample sentences. Student responses are typed on the keyboard and checked by the computer. Results are displayed on the screen and (if connected) on a printer. **REQUIRES 16K EXT. BASIC $19.95**

MATH DRILL is a program designed to help children to practice addition, subtraction, multiplication, and division skills on the COLOR COMPUTER. It has several features that make its use particularly attractive.

- Up to 6 students may use the program at the same time.
- Answers for addition, subtraction and multiplication are entered from right to left, just as they are written on paper.
- Commas may be included in the answers.
- Partial products for the multiplication problems may be computed on the screen.
- Division answers that have a remainder are entered as a whole number followed by the letter "R" and the remainder.
- There are ten, user modifiable, skill levels.
- A "SMILEY FACE" is used for motivation and reward. Its size increases relative to the skill level.
- Skill levels automatically adjust to the student's ability.
- A timer measures the time used to answer each problem and the total time used for a series of problems.
- After a problem has been answered incorrectly the correct answer appears under (above in division) the incorrect answer.

REQUIRES 16K EXT BASIC $19.95

WORD DRILL is designed to give a multiple choice vocabulary quiz. Words and definitions are entered into the program from the keyboard or from a tape file. The computer displays a randomly chosen definition and eight word choices. The student must enter his response before a built in timer reaches zero.
REQUIRES 16K EXT. BASIC $19.95

SEARCH-A-WORD This Program generates a word search puzzle to your specifications. You specify the size of the puzzle and the number of words that it is to hide within the puzzle. 16K or 32K Ext. Basic.
TAPE $17.95 **FLEX VERSION $27.95**

EDUCATIONAL PACKAGE — *SPELLING TEST* —
WORD DRILL — MATH DRILL — ESTIMATE —
ALL FOR — $69.95

ESTIMATE is a program designed to help children to practice estimating the answers to addition, subtraction, multiplication and division problems on the COLOR COMPUTER. It has many features that make its use particularly attractive:

- Up to 5 students may use the program at the same time.
- There are 5, user modifiable, skill levels.
- The acceptable percent error may be changed as a student's skill improves.
- A timer measures the number of seconds used to answer each problem and the total time used for a series of problems.
- If a problem has been answered incorrectly, the student is told the percent error and asked to try again.
- If a problem is answered incorrectly a second time, the student is told the correct answer and the range of acceptable answers is displayed.
- A report is given at the end of each set of problems that includes the number of problems done, the number of problems answered correctly on the first try and the average percent error.
- The (BREAK) key has been disabled so that a child will not inadvertently stop the program from running.

16K EXT. BASIC $19.95

TEACHERS' DATABASE is a program designed to allow a teacher to keep a computerized file of information about his/her students. There are many features that make this program particularly attractive.

- Information on as many as 100 students (or more) may be in the computer at one time.
- Each student may have as many as 20 (or more) individual items of data in his/her record.
- The program will run from cassette or disk.
- Cassette and disk files are completely compatable.
- The program is menu driven.
- Records may be easily changed, deleted, combined or added.
- Information about students may be numerical or text.
- Records may be quickly alphabetized.
- Records may be sorted by various criteria.
- Records may be reordered (ranked) based on test scores or other data.
- Data displayed during a sort may be printed on a printer or saved on disk or cassette as a new file.
- A full statistical analysis of data may be done and sent to the printer.
- Student test scores may be weighted. **32K EXT BASIC TAPE $39.95**

DISC $42.95

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```
7096 GOTO 7070
7097 CLOSE#-1:RETURN
7200 :
7900 REM:  ADD STATS
8000 CLS:SOUND1,5:FOR  Y=1  TO 15
8010 CLS:IF Y=16 THEN 8100
8020 PRINT PL$(Y)"S"" HITS THIS
GAME"
8030 INPUT H2:
8040 HT=VAL(HT$(Y))
8050 HT$(Y)=STR$(HT+H2)
8060 Y=Y+1: GOTO 8010
8080 :
8090 :   REM:  ADD AT BATS
8100 SOUND1,5:FOR Y=1 TO 15
8110 CLS: IF Y=16 THEN 8200
8120 PRINT PL$(Y)"S"" AT BATS TH
IS GAME"
8130 INPUT H3:
8140 AB=VAL(AB$(Y))
8150 AB$(Y)=STR$(AB+H3)
8160 Y=Y+1: GOTO 8110
8180 :
8190 :  REM: ADD RUNS
8200 SOUND1,5:FOR Y=1 TO 15
8210 CLS:IF Y=16 THEN 8300
8220 PRINT PL$(Y)"S"" RUNS THIS
GAME"
8230 INPUT R2:
```

```
8240 R=VAL(R$(Y))
8250 R$(Y)=STR$(R+R2)
8260 Y=Y+1: GOTO 8210
8280 :
8290 :  REM: ADD STRIKE OUTS
8300 SOUND1,5:FOR Y=1 TO 15
8310 CLS:IF Y=16 THEN 8400
8320 PRINT PL$(Y)"S ""STRIKE OUT
S THIS GAME"
8330 INPUT K2:
8340 K=VAL(K$(Y))
8350 K$(Y)=STR$(K+K2)
8360 Y=Y+1: GOTO 8310
8380 :
8390 : REM: ADD WALKS
8400 SOUND1,5:FOR Y=1 TO 15
8410 CLS: IF Y=16 THEN 8500
8420 PRINT PL$(Y)"S"" WALKS THIS
 GAME"
8430 INPUT B2:
8440 B=VAL(BB$(Y))
8450 BB$(Y)=STR$(B2+B)
8460 Y=Y+1:GOTO 8410
8480 :
8490 : REM NEW AVERAGES
8500 FOR Y= 1 TO 15
8510 CLS: IF Y= 16 THEN30
8530 LET HT=VAL(HT$(Y)):LET AB=V
AL(AB$(Y))
```

COLOR COMPUTER and TDP-100 OWNERS !!!

DO YOU HAVE A 32K SYSTEM WITH 64K MEMORY CHIPS?? ARE YOU STILL BEING TOLD YOU CAN ONLY USE 32K FROM BASIC??

DON'T BELIEVE IT! - KEY COLOR SOFTWARE brings you the KEY-264K. An exciting NEW SOFTWARE utility that allows any STANDARD 32K COLOR COMPUTER TO ACCESS 64K RAM FROM BASIC, and with NO HARDWARE MODIFICATIONS REQUIRED!!!

The KEY-264K divides the 64K ram memory into two 32K banks or sides, each of which can be utilized independently by the BASIC interpreter, with the ability to switch instantly from one side to the other. IT'S LIKE HAVING TWO COMPUTERS IN ONE!! Have your BASIC program on one side and keep your variables on the other side, or have your main program on one side and your subroutines on the other side, or have your program on one side and use the other side for 4 additional HI-RES pages, or any combination you like. The possibilities are endless because the KEY-264K allows full communication between sides plus the ability to switch back and forth at will, all from within BASIC. You could also have different programs in each side and switch back and forth between them using simple keystrokes, even while the programs are running!! Or run them both at the same time in the FOREGROUND/BACKGROUND MULTI-TASKING mode. Don't buy that printer buffer yet! With the KEY-264K you can be printing in the background side while utilizing your computer normally in the foreground side AT THE SAME TIME!!! Debugging a program? Use either a BASIC command or simple keystrokes to instantly duplicate your program, in it's present status, onto the opposite side. Switch to the opposite side later and pick up exactly where you were before!

For DISK users, the KEY-264K allows you to alternate between DISK and EXTENDED BASIC on the same side with simple keystrokes. No need to pull your disk controller or power down. You can be in EXTENDED BASIC on one side and in DISK BASIC on the other side and still switch back and forth and have full communications between the two sides.

The KEY-264K does all this and MORE thru extensions to the BASIC interpreter, No need to learn a new language!!! In total the KEY-264K adds 15 NEW COMMANDS and 1 function to BASIC, including powerful new BLOCK MEMORY MOVE and GRAPHICS VIEWING commands.

NOTHING ELSE LIKE IT - YOU HAVE TO SEE IT TO BELIEVE IT !!!!!!

The KEY-264K works on 32K systems with "E", "F", or even modified "D" boards and requires EXTENDED or DISK BASIC with GOOD 64K MEMORY CHIPS! Systems with piggy-back 32K or half-good 64K memory chips WILL NOT WORK!!!

ORDER YOUR KEY-264K CASSETTE TODAY by sending check or money order for $39.95 plus $2.00 shipping and handling (Mass. residents add 5% sales tax) to:

KEY COLOR SOFTWARE
P.O. BOX 360
HARVARD MA. 01451

```
8535 IF AB=0THEN AB=1
8540 AV=HT/AB*1000
8550 GOTO 30
8900 CLEAR 500
9000 CLS
9006 PRINTTAB(9)"PITCHING STATS"
9007 PRINT STRING$(32,"*")
9010 PRINTTAB(7) "WHICH DO YOU W
ANT"
9015 PRINT STRING$(32,"-")
9020 PRINTTAB(8) "(1) LIST PITCH
ERS"
9030 PRINTTAB(8) "(2) ADD TO LIS
T"
9040 PRINTTAB(8) "(3) INPUT STAT
S"
9050 PRINTTAB(8) "(4) PRINT STAT
S"
9060 PRINTTAB(8)"(5) ADD TO STAT
S"
9070 PRINTTAB(8) "(6) SAVE TO TA
PE"
9080 PRINTTAB(8) "(7) LOAD FROM
TAPE"
9085 PRINTTAB(8)  "(8) RETURN TO
 MENU
9090 PRINTTAB(13) "(1-7) ?"
9100 INPUT W
9110 ON W GOSUB 9190,9200,9310,9
820,10000,10500,10600,30
9120 IF W$=""THEN 9110
9130 :
9160 REM:  INPUT PITCHERS
9180 :
9190 CLS:FORY=1TO 7
9200 Y=Y:CLS
9210 PRINTTAB(11)"INPUT PITCHERS
"
9220 PRINT"PRESS<ENTER>WHEN FINI
SHED"
9230 PRINT"PITCHER" Y;
9240 INPUT PT$(Y)
9250 IF PT$(Y)="" THEN 9000
9260 Y=Y+1
9270 GOTO 9230
9290 :
9300 REM: INPUT STATS
9310 CLS:FORY=1TO7
9320 PRINT"PRESS<ENTER>WHEN FINI
SHED"
9330 PRINT:PRINT"HITS GIVEN UP B
Y "PT$(Y)
9340 INPUT HG$(Y)
9350 IF HG$(Y)="" THEN 9410
9360 Y=Y+1
9370 GOTO 9330
```

DATABASE / MAILER - 'CC-DBM' $49.95
LETTER WRITER - 'CC - LW' $39.95

introductory offer - FREE! CC-LW with the purchase of CC-DBM

Database/Mailer "CC - DBM" 16K or 32K

- Simple to use even for the novice
- Active Main Menu guides user to valid operations.
- 32K disk (or tape) allows 59, (61) to 338, (351) records.
- 16K disk (or tape) allows 12, (15) to 72, (86) records.
- 4 to 10 fields, 5 to 27 widths, 20 to 270 char./record.
- All user definable with default values for ease of use.
- Automatic memory sense adjusts to the size of your system.
- Fast Basic sort by any field with "Percent Sorted" display.
- Automatically adjusts for empty address lines - no gaps.
- Print up to 9 line labels on envelopes or mailing labels.
- Optional special printer codes for customized labels.
- Master printout with 2 column format including field name.
- Automatically prints header with date, paging and filename.
- Works with any printer, use friction or tractor feed.
- Selective printing by any field or field range.
- Optional multiple copies of mailing labels.
- Single screen 10 record display by user defined field.
- Single key entry provides hard copy of screen data.
- Comprehensive 25 page users manual with flow diagrams.
- Includes detailed instructions for user modification.

★ Compatible with CC-LW for mail-merge, form letters, etc.

Letter Writer "CC - LW" 16K or 32K

- Much easier to use than a 'word processor.
- Allows fast single page letter writing.
- Embedded commands for centering, multiple line skip, tabbing and optional indent new paragraph.
- 16K or 32K tape or disk.
- Edit mode allows you to delete or insert text.

★ Uses CC-DBM data files for form letter capability.

- Works with any printer and standard paper.
- Excellent users manual.

CC - DBM 16K, 32K disk or tape	$49.95
CC - LW 16K, 32K disk or tape	$39.95

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California residents please add sales tax - 6%.
Allow 2 weeks for personal checks.

```
9390 :
9400 : REM: INNINGS PITCHED
9410 CLS:FORY=1TO7
9420 PRINT"PRESS<ENTER>WHEN FINI
SHED"
9430 PRINT"INNINGS PITCHED FOR "
;PT$(Y)
9440 INPUT IP$(Y)
9450 IF IP$(Y)=""THEN 9520
9460 Y=Y+1
9470 GOTO 9430
9500 :
9510 REM: STRIKE OUTS
9520 CLS:FORY=1TO7
9530 PRINT"PRESS<ENTER>WHEN FINI
SHED"
9540 PRINT"STRIKE OUTS FOR "PT$(
Y)
9550 INPUT SO$(Y)
9560 IF SO$(Y)=""THEN 9620
9570 Y=Y+1
9580 GOTO 9540
9600 :
9610 REM:  WALKS
9620 CLS:FORY=1TO7
9630 PRINT"PRESS<ENTER>WHEN FINI
SHED"
9640 PRINT"WALKS GIVEN UP BY "PT
$(Y)
9650 INPUT W$(Y)
9660 IF W$(Y)=""THEN 9720
9670 Y=Y+1
9680 GOTO 9640
9700 :
9710 REM:  EARNED RUNS
9720 CLS:FORY=1TO7
9730 PRINT"PRESS<ENTER>WHEN FINI
SHED"
9740 PRINT"EARNED RUNS ALLOWED B
Y "PT$(Y)
9750 INPUT ER$(Y)
9760 IF ER$(Y)="" THEN 9000
9770 Y=Y+1
9780 GOTO 9740
9800 :
9810 : REM: PRINT STATS
9820 CLS: FOR Y=1 TO 7
9830 PRINT@10,"HT":PRINT@13,"IP"
9840 PRINT@17,"K":PRINT@20,"BB"
9850 PRINT@24,"R":PRINT@27,"ERA"
9860 LET ER=VAL(ER$(Y))
9870 LETIP=VAL(IP$(Y))
9880 IFER=0THENEV=0
9881 IF ER=0THEN 9897
9890 EV=ER/IP*7
9891 IF LEN(HG$(Y))<3THENHG$(Y)=
HG$(Y)+" ":GOTO9891
9892 IFLEN(IP$(Y))<4THENIP$(Y)=I
P$(Y)+" ":GOTO 9892
9893 IFLEN(SO$(Y))<3THENSO$(Y)=S
O$(Y)+" ":GOTO 9893
9894 IFLEN(W$(Y))<4THENW$(Y)=W$(
Y)+" ":GOTO9894
9895 IFLEN(ER$(Y))<3THENER$(Y)=E
R$(Y)+" ":GOTO 9895
9896 IF LEN(PT$(Y))<8THENPT$(Y)=
PT$(Y)+" ":GOTO 9896
9897 EV$=STR$(EV)
9898 IF LEN(EV$(Y))<5THENEV$(Y)=
EV$(Y)+" ":GOTO9898
9900 PRINT PT$(Y)TAB(10)HG$(Y) I
P$(Y) SO$(Y) W$(Y) ER$(Y) EV
9910 Y=Y+1
9920 IF Y=8 THEN 9930 ELSE 9860
9930 PRINT"PRESS<ENTER>TO CONTIN
UE":INPUT C$
9940 GOTO 9000
9960 :
9970 :  REM:  ADD STATS
10000 CLS: FOR Y=1 TO 7
10010 CLS:IF Y=8 THEN 10070
10020 PRINTTAB(7)"ADD TO PITCHIN
G STATS"
10030 PRINT:PRINT PT$(Y)"S"
10035 PRINT:PRINT"INNINGS PITCHE
D THIS GAME"
10040 INPUT I2:IP=VAL(IP$(Y))
10050 IP$(Y)=STR$(IP+I2)
10060 Y=Y+1:GOTO 10010
```

COLOR—FORTH
Including SEMIGRAPHIC-8 EDITOR
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- Disk and Tape utilities
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602-996-1717

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FOR THE COLOR COMPUTER

All programs are in 16K machine language unless noted.

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*	**COLOR HAYWIRE** Classic arcade game, rated A+ by Color Computer magazines.	$19.95

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*	**MS. GOBBLER** (32K) Outstanding Pac Man-type game with 4 different mazes and 16 skill levels.	$21.95
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**	**SPACE RACE** Maneuver yourself in space but alien ships appear and must be destroyed. Hi-Res Graphics and Sound.	$21.95
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*	**DEFENSE** Defend your spaceships from enemy laser beams.	$21.95
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**	**SPACE INVADERS** Fast action Invader game. Excellent Graphics and Sound.	$17.95
*	**GHOST GOBBLER** Highly rated Pac Man-type game. 16 skill levels and lots of action.	$19.95
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TOM MIX SOFTWARE

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THE CORNSOFT GROUP

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```
10070 INPUT"PRESS ENTER TO CONTI
NUE";G$
10075 ON G GOTO 10110
10080 GOTO 10110
10090 : REM: ADD HITS
10100 :
10110 CLS:FOR Y=1 TO 7
10112 CLS:IF Y=8 THEN 10160
10115 PRINT PT$(Y)
10120 PRINT:PRINT"HITS GIVEN UP
THIS GAME"
10130 INPUT H2:HT=VAL(HG$(Y))
10140 HG$(Y)=STR$(H2+HT)
10150 Y=Y+1:IF Y=8 THEN 10160 EL
SE 10112
10160 INPUT"PRESS<ENTER>TO CONTI
NUE";G$
10165 GOTO 10200
10190 :
10195 : REM ADD STRIKE OUTS
10200 CLS: FOR Y=1 TO 7
10205 CLS:IF Y=8THEN 10260
10207 CLS: IF Y=8 THEN 10250
10210 PRINT PT$(Y)
10215 PRINT:PRINT"STRIKE OUTS TH
IS GAME"
10220 INPUT S2:LETSO=VAL(SO$(Y))
10230 SO$(Y)=STR$(S2+SO)
10240 Y=Y+1:IFY=8 THEN 10250 ELS
E 10205
10250 INPUT"PRESS<ENTER>TO CONTI
NUE";G$
10260 GOTO 10300
10280 : REM: ADD WALKS
10300 CLS:FOR Y=1 TO 7
10305 CLS:IF Y=8 THEN 10370
10307 CLS:IF Y=8 THEN 10360
10310 PRINT PT$(Y)
10320 PRINT:PRINT"WALKS GIVEN UP
 THIS GAME "
10330 INPUT W2:LET W=VAL(W$(Y))
10340 W$(Y)=STR$(W2+W)
10350 Y=Y+1:IFY=8 THEN 10360 ELS
E 10305
10360 INPUT"PRESS<ENTER>TO CONTI
NUE";G$
10370 GOTO 10400
```

```
10380 :
10390 : REM: ADD EARNED RUNS
10400 CLS:FOR Y=1 TO 8
10405 CLS:IF Y=8 THEN 10470
10410 PRINT PT$(Y)
10420 PRINT:PRINT"EARNED RUNS TH
IS GAME"
10430 INPUT E2:ER=VAL(ER$(Y))
10440 ER$(Y)=STR$(E2+ER)
10450 Y=Y+1:IFY=8 THEN10460  ELS
E 10405
10460 PRINT"PRESS<ENTER>TO CONTI
NUE"
10470 GOTO 9000
10495 :  REM: SAVE TO TAPE
10496 :
10500 CLS: PRINT @135,"SAVE ITEM
S ON TAPE"
10510 PRINT@234,"POSITION TAPE"
10520 PRINT@294,"PRESS PLAY AND
RECORD"
10530 PRINT@388,"PRESS<ENTER>WHE
N READY"
10540 INPUT Q$
10550 OPEN "O",#-1, "STATS"
10560 FOR Y=1 TO 8-1
10570 PRINT#-1,PT$(Y),HG$(Y),IP$
(Y),SO$(Y),W$(Y),ER$(Y),EV(Y)
10580 NEXT Y
10590 CLOSE #-1: GOTO 9000
10593 :
10594 : REM: LOAD FROM TAPE
10600 CLS: PRINT@235,"REWIND TAP
E"
10610 PRINT@300,"PRESS PLAY"
10620 PRINT@388,"PRESS<ENTER>WHE
N READY"
10630 INPUT Q$
10640 OPEN "I",-1,"STATS"
10650 Y=1
10660 IF EOF(-1) THEN 10695
10670 INPUT #-1,PT$(Y),HT$(Y),IP
$(Y),SO$(Y),W$(Y),ER$(Y),EV(Y)
10680 PRINT PT$(Y)
10685 Y=Y+1
10690 GOTO 10660
10695 CLOSE #-1: GOTO 9000
```

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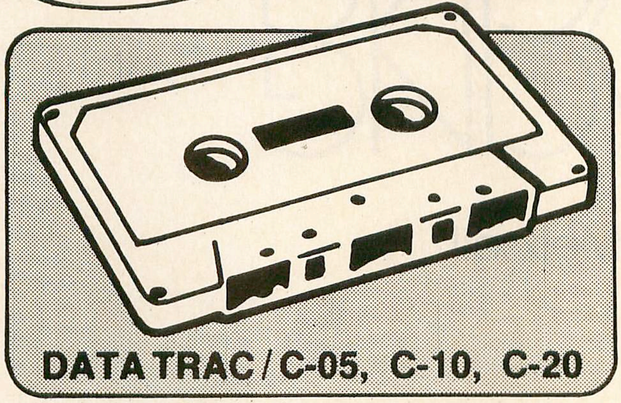

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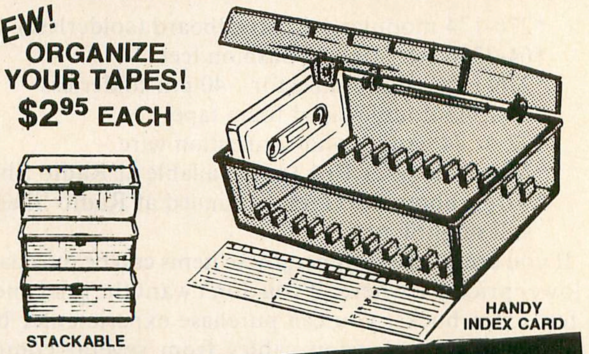

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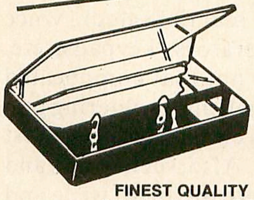

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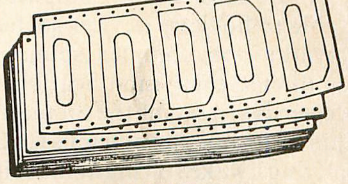

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BUILD THIS BOARD FOR EASY INTERFACING

By Dennis Meixsell

I'm sure most Color Computer owners would love to be able to hook up devices such as a real time clock, voice synthesizer, complex sound generators, keypads, etc. Even though these modifications are not that complicated or expensive, it seems the thought of getting a soldering gun within 10 feet of our precious CoCo is enough to leave most of us lying awake staring at the ceiling. Also, such words and phrases as address lines, data bus, interrupt, read/write and clock begin to totally overwhelm us.

Well, I have some good news. In this article you will learn the basic steps of interfacing without taking the back off your CoCo. All the connecting will be done through the cartridge port using inexpensive and readily available parts (most coming from "Mama" Radio Shack herself). For the experienced hobbiest this may be all you need to get over the hump and into some serious projects. For the newcomer there is plenty to learn about interfacing, but this first step will give you what you need to begin experimenting.

The standard device used for interfacing is the Motorola 6921, called the Peripheral Interface Adapter. The PIA, as we will refer to it, decodes specific addresses, incorporates timing and provides memory port addressing. It provides two eight bit ports with each bit selectable as an output or input port. This will be explained in more detail later in this article.

Our project is to build an experimenter's board and hook up a PIA. This board will be versatile and the foundation of future experiments. Once this project is finished, most additional interfacing will be a snap. So hang in there and the rewards will be great. The construction will involve three steps; making a ribbon connector, building the experimenter's board and interfacing the PIA.

Parts to be used are as follows:

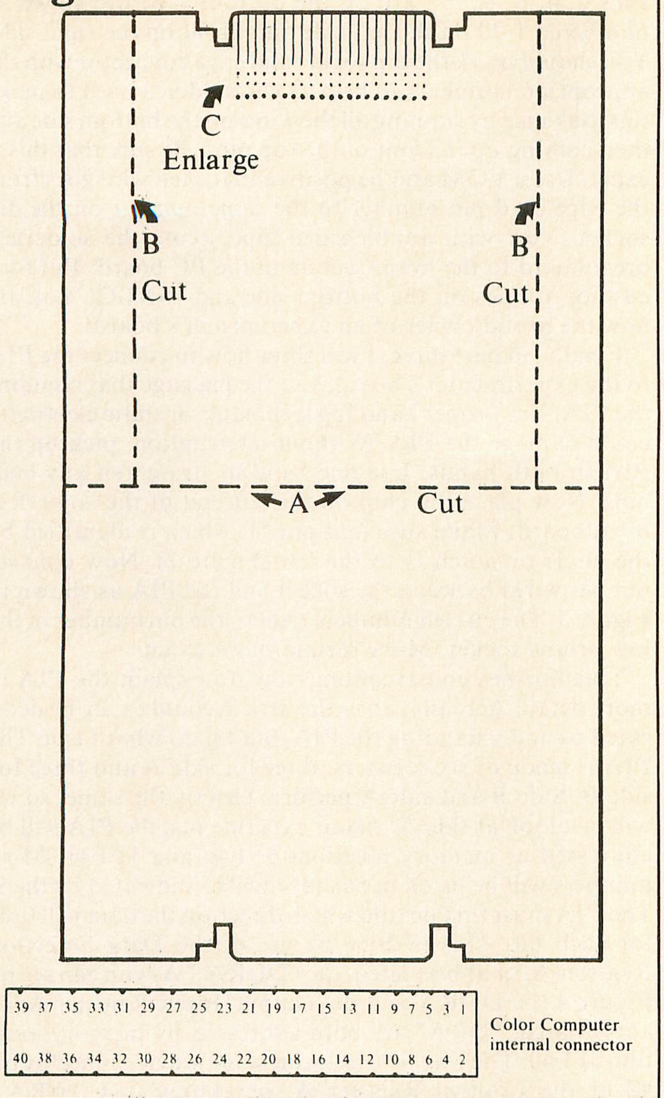
*276-165 computer PC board
*276-174 modular I.C. breadboard (solderless)
*64-2346 self-sticking cushion feet
*276-1558 edge connector—40 pin solderless
*64-2343 double-sided foam tape
*22 or 24 gauge solid connection wire
*Motorola 6821 PIA (not available at Radio Shack)
*wire ribbon, 2 feet (discontinued at Radio Shack but still might have it)

If you are a wise shopper, these items can be purchased at a lower price elsewhere. If you don't want the grief and have a few extra bucks, you can purchase experimenter boards and pre-made extension cables from several companies found in this magazine.

The first step is for convenience and to protect the edge connector inside the CoCo. What we will make is simply a connector extender; that is, a 40-pin extension cord. You may want to leave this in the CoCo permanently and plug all cartridges into the ribbon connector. Take the 276-165 computer connecting board and cut *it in half* along the dotted line marked A (Figure 1). Put the bottom half aside, it will be used later. Then cut along the two dotted lines marked B. With the CoCo off, plug this board into the cartridge port to see if you did a good job cutting. Be sure to keep it level with the CoCo. If it is raised too high or low it may damage the CoCo's internal connector. Be sure to keep the printed side up and the copper side down in all steps. Remove the board from the CoCo. The next step is to solder the 40-wire ribbon to this board.

From one end of a two-foot section of 40-wire ribbon cable, separate each wire back about 3" with a knife. Then strip ¼" of insulation from the end of each of the 40 wires. This is a tedious and difficult job. I usually roll a knife over each wire on a hard surface. Be very careful. This may take some practice. Next, slightly enlarge the holes marked C

Figure 1



(Figure 1). There are 20 of these and they need to be large enough to allow a strand of the 40-wire cable to pass through, insulation and all. Now thread every other wire from the ribbon cable through the holes marked C. Start on the right and put wire #1 through that hole. Be sure that pin #1 on this edge connector will line up with pin #1 on the solderless connector that will be placed on the other end of the cable. If in doubt, use a volt-ohm meter and check it out. Now you must solder each of the wires to the base of the corresponding prong on the 40-pin edge connector. After this is accomplished tape the ribbon to the PC board to act as a strain release. On the bottom of the PC board tape a ¼" thick piece of plastic or wood to insure that the edge connector stays parallel with the CoCo's connector. Put the solderless 40-pin connector on the free end of the cable. A small hammer will help to lightly tap the back piece in place. Now mark in large, clear letters "TOP" and "BOTTOM" on both the edge card and the 40-pin connector (this will save much frustration later). Put this aside—the hard part is over.

The second phase will use the bottom half of the PC board, the 40-pin socket and connecting wire. Place the 40-pin socket on the printed side of the PC board in the location shown on Figure 2. Look at the copper side of the board and make sure each leg is going through an individual copper pad. Solder the socket into place. Now solder a wire from each pin of the edge card to the appropriate pin of the

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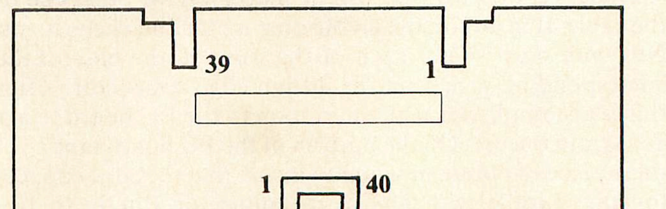
40-pin socket. Pin 1, 3, 5, 7, 9, . . . are on top of the PC board. Pins 2, 4, 6, 8, . . . are on the bottom. The dip socket is numbered 1-20 on the left side and 21-40 on the right side. You should mark the dip socket and edge connector with the appropriate numbers to help as you solder. I tried to make this look nice by running all the wires on the bottom side and then coming up in front of the top pins. Be sure that this is exact. Use a VOM and be positive that each wire goes from the edge card pin number to the same number on the dip socket. Now with double-sided tape secure the solderless breadboard to the lower section of the PC board. Put four cushion footies on the bottom side and BINGO! You are now the proud owner of an experimenter's board!

Finally, in part three, I will show how to connect the PIA to the experimenter's board. Get the package that contains the PIA. Use proper handling technique, or static electricity could damage the PIA. Without interruption, pick up the PIA in both hands. Use one hand to straighten any bent pins. Now place the chip on the left end of the solderless breadboard. Make sure that pin #1, which is identified by the circle or notch is to the left (Figure 2). Now connect jumper wires between the socket and the PIA as shown in Figure 3. The circled numbers refer to the pin number of the low profile socket. Make certain this is exact.

This finishes construction. Now, to explain the PIA in more detail. Actually, an entire article could easily be dedicated to understanding the PIA, but I'll do what I can. The PIA is made of six registers, three for side A and three for side B. Side B and side A perform exactly the same, so we will just look at side A. In our experiments, the PIA will be addressed at memory locations $FF40 and $FF41. Most numbers will be listed in hexadecimal as indicated by the $. The PIA must first be told which direction the data will flow for each bit. This is done by use of the Data Direction Register A, or abbreviated, the "DDRA." As you can see by Figure 4 the DDRA and the Output/Input Register A, or abbreviated, "ORA" are both addressed by memory location $FF40. The way to select which one is determined by bit #2 of the Control Register A, or abbreviated, "CRA," located at $FF41. If a "0" is put in bit #2 of Control Register A then location $FF40 will be addressing the DDRA. If a "1" is in bit #2 of CRA then address $FF40 will be addressing the ORA. Now, if we put a "1" in a bit of the DDRA,

Figure 2



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then the corresponding bit of the ORA will be set for output. Put a "0" in a bit of DDRA and the corresponding bit of ORA will be set for input. Okay, got all that? I'm sure that all is about as clear as mud! Let me go on; an example should help. If we want to set all the ORA to output we should do as follows:

```
POKE $FF40,$FF   'SELECT DATA DIREC
                  TION REG. A
POKE $FF40,$FF   'PUT A "1"IN EACH BIT
                  OF DDRA
POKE $FF41,04    'CHANGE TO OUTPUT
                  REG. A
```

Now any byte poked into $FF40 will show up at pins 2-9 of the PIA. To set all bits as inputs we must:

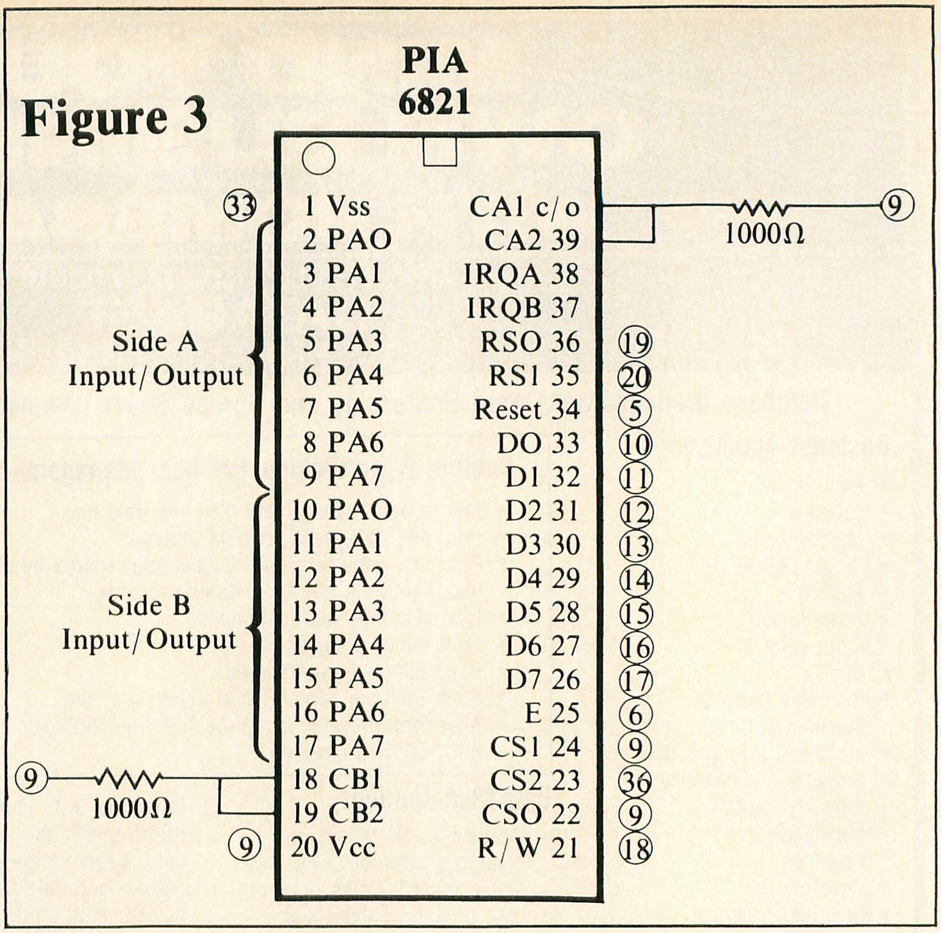
```
POKE $FF41,00    'SELECT DATA DIREC
                  TION REG. A
POKE $FF40,00    'PUT A "0" IN EACH BIT
                  OF DDRA
POKE $FF41,04    'CHANGE TO OUTPUT/
                  INPUT/INPUT REG. A
```

Now anytime pins 2-9 have a logic 0 or 1 this will show up when we peek ($FF40).

Run this next program with the PIA hooked up. Register A should be equal to zero, as shown on the screen. Use a jumper wire and connect pin #2 to pin #1. Pin #1 is ground and pin #2 is bit 0 of DDRA. Register A should now read "1." Ground pins 2-9, one at a time and watch the screen.

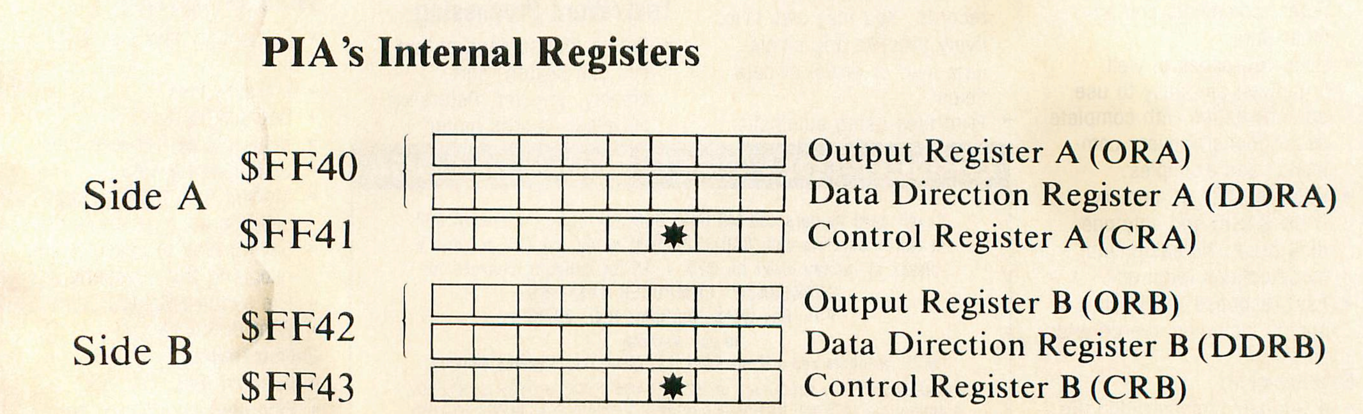
```
1 ' ***** THIS PROGRAM WILL READ SIDE A OF
        THE PIA
5 CLS
80  A=&HFF40             'LOCATION OF PIA
200  POKE  A+1,00        'SELECT DATA DIRECTION
                           REG. A
210  POKE  A,00          'PUT A "0" IN EACH BIT
220  POKE  A+1,04        'CHANGE TO OUTPUT/INPUT
                           REG. A
230  P=PEEK(A)           'READ THE PIA
300  R=255-P             'LITTLE CONVERSION
310  PRINT@ 110,R        'SHOW US THE VALUE
330  GOTO 230            'READ IT AGAIN SAM
```

Figure 3


PIA
6821
㉝
1 Vss
2 PAO
3 PA1
4 PA2
5 PA3
6 PA4
7 PA5
8 PA6
9 PA7
10 PAO
11 PA1
12 PA2
13 PA3
14 PA4
15 PA5
16 PA6
17 PA7
18 CB1
19 CB2
20 Vcc
CA1 c/o
CA2 39
IRQA 38
IRQB 37
RSO 36
RS1 35
Reset 34
DO 33
D1 32
D2 31
D3 30
D4 29
D5 28
D6 27
D7 26
E 25
CS1 24
CS2 23
CSO 22
R/W 21
⑲
⑳
⑤
⑩
⑪
⑫
⑬
⑭
⑮
⑯
⑰
⑥
⑨
㊱
⑨
⑱
1000Ω
⑨
Side A
Input/Output
Side B
Input/Output
⑨
1000Ω
⑨

I can see the wheels starting to turn already . . . buttons . . . switches . . . a keypad . . . maybe I could build an alarm system . . . just maybe I could? Welcome to the world of interfacing. In part two I will show how to interface a calculator keyboard. This should only take about one hour. Then I'll explain more about the PIA and the different lines coming out of the CoCo. I know there has been quite a large amount of material presented here. Don't worry if you didn't understand it all—just have fun and play with the PIA. It's not necessary to understand every detail to build these projects. Just stick in there and before you know it you'll be interfacing like an old pro.

Figure 4


PIA's Internal Registers
Side A
$FF40
$FF41
Output Register A (ORA)
Data Direction Register A (DDRA)
Control Register A (CRA)
Side B
$FF42
$FF43
Output Register B (ORB)
Data Direction Register B (DDRB)
Control Register B (CRB)

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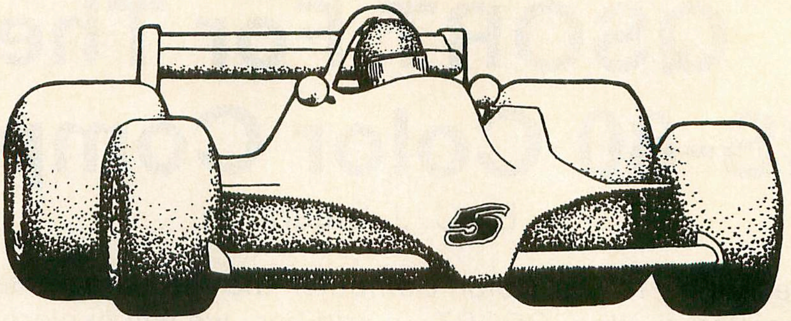

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DESIGNED WITH YOU IN MIND

Revolution is menu-driven, and self explanatory. Information screens tell you what you need to know. When you're ready to play, a menu of the names of all your tracks is displayed, along with the lap record for each track and the name of the person who set that lap record. You select a track with a single keystroke, and *Revolution* takes you there.

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QSORT For The TRS-80 Color Computer

By C. J. Stearman

This two part article brings to the Color Computer the fast and versatile number and string sorting routine, QSORT. In addition, we will explore the way numbers and strings are represented by Microsoft BASIC.

Sooner or later the need arises in BASIC programs to sort large amounts of data. If you've arrived at this point and written BASIC routines to perform bubble sorts and the like, you know they can be painfully slow. Even a sort of tens of items can take upwards of a minute. Therefore, a machine code routine, callable from BASIC, would make a very useful addition to our utility program library.

Sorting is a complex science and much research has been done to discover fast, efficient methods. Unfortunately I know little of the subject and was always on the lookout for articles describing sort methods. I finally came across one describing an implementation of *Quicksort* for the TRS-80 Model 1 by Don Brumm (80 Micro, November, 1982). It boasted some impressive sorting times; eight seconds to sort 1000 strings, 23 seconds to sort 3000!

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I wanted this capability for my Color Computer and felt it worth the effort to develop a similar program. The result of this will be described in this and the next issue. I learned much about the way strings and numbers are handled by Microsoft BASIC and this knowledge is generally useful. I also discovered ways of using BASIC functions (such as RND) from machine code.

In this issue we will look at these subjects and implement the final algorithm in BASIC. The next issue will list the assembly language version and describe its operation in detail.

Program Requirements

If the final sort program was to be really useful, it would have to be versatile, as well as fast. Probably it would be necessary to trade off some speed to ensure that versatility. I felt that it should be able to:

*Sort string and number arrays
*Sort in ascending and descending order
*Sort strings in any character order
*Sort parts of the array only
*Contain thorough call error detection
*Sort 1 and 2 dimensioned arrays
*Include or exclude the second dimension in 2 dimension sorts
*Sort either dimension in 2 dimension arrays

The desirability of some of these features will become obvious as we get into this further.

If we are to sort numbers and strings using a machine code routine it is going to be necessary to understand how these are stored by BASIC, so let's explore that next.

Inside BASIC

BASIC used 5 bytes of storage to describe a number or string of characters. Numbers are stored in a floating point format within these 5 bytes. In the case of strings, the 5 bytes contain details of where the string is and how long it is. The string itself is elsewhere in memory. It is important to note that the Color Computer has no capability to store numbers as integers. This fact will figure in some decisions later.

(Mr. Stearman is Field Engineering Manager for Boston Digital Corp., a manufacturer of precision, computer-controlled milling machines. He was born and educated in England and has lived in the U.S.A. since 1970.)

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Strings

Looking at the 5 byte descriptor for a string, we find that the first byte contains a count of the number of characters in the string, and the third and fourth contain a 16 bit address of the first character. With these two pieces of information the whole string can be accessed. The second and fifth bytes are "reserved for the computer" to quote the manual, and seem to always be zero. So string desciptors are simple to understand.

Numbers

By comparison, numbers are much more complex. These 5 bytes must store a decimal number in the range +/-10/\38! To do this, the number must be stored as a binary value in the form:

MANTISSA x 2/\EXPONENT

where the mantissa is a 32 bit, signed binary number in the range:

1.0000000 00000000 00000000 00000000 (Base 2)
to
1.1111111 11111111 11111111 11111111 (Base 2)

and the exponent is an 8 bit, signed binary number in the range:

-126 to +126 (Base 10)

No doubt this looks pretty confusing! However, it is akin to the practice of representing numbers in scientific notation. For example, the decimal value 123.456 can be represented as 1.23456 x 10/\2. Or the decimal number -0.00123 becomes -1.23 x 10/\-3. This action is called normalizing. In binary normalized numbers the mantissa is always in the signed range of 1 to 2 (inclusive of 1 but exclusive of 2).

Looking at the way BASIC actually stores this, the first byte contains the exponent. If the Most Significant Bit (MSB) is a zero the exponent is negative, if a *1* it's positive. The remaining 7 bits describe the value of the exponent "plus one." This "wrinkle" is needed because the number "zero" is a special case. It is represented by the exponent byte being zero. In this case, the 4 mantissa bytes are immaterial. However, an exponent of zero is a valid value, so the exponent must be "offset" by one to allow for its representation. This also explains why the exponent range is 126, not 127. Exponent 126 is stored as 127, the highest value which can be contained in 7 bits.

As the mantissa is always "one point something," this 1 can be assumed, and the MSB of the most significant byte can be used to store its sign. This time a 1 indicates negative, and a 0 positive.

If you're thoroughly confused now, let's look at a couple of examples. Take the decimal number 9.625 and "code" it first. It is represented in binary by 1001.101 (going from the binary point right, the 1 represents 1½; then ¼; 1⅛ etc.). Normalizing this, it becomes 1.001101 x 2/\3 (2/\3 shown in decimal). The mantissa is positive, as is the exponent so the result is:

Byte 1 : 10000100 (exponent+1)
Byte 2 : 00011010 (sign + fraction)
Byte 3 : 00000000
Byte 4 : 00000000
Byte 5 : 00000000

As a second example, take the value -0.09375 (decimal). This is -0.00011 in binary. Normalizing it becomes -1.1 x 2/\-4 (mantissa in base 2, rest in base 10). Converting according to the rules above:

Byte 1 : 01111101 (negative,-4+1 in 7 bit 2's complement)
Byte 2 : 11000000 (negative and fraction part)
Byte 3 : 00000000
Byte 4 : 00000000
Byte 5 : 00000000

Having nearly 32 bits to represent the mantissa provides the ability to handle decimal numbers with 9 significant digits. Using the normalized format with an exponent of 7 bits allows the large value range.

Floating Point Accumulator

Numbers are stored in memory as described above. However, when a BASIC function uses them they are passed through the Floating Point Accumulator (FAC). This is six bytes in memory starting at 6F (Hexadecimal). Note it is six, not five. Numbers are represented in it slightly differently from in memory. Bytes 1, 3, 4 and 5 are the same. Byte 6 in the FAC is the same as byte 2 in memory. Byte 2 in the FAC is the same as byte 2 in memory, except that the MSB is always 1. This arrangement allows byte 6 to represent the mantissa sign, while bytes 2 through 5 represent the true absolute value of it.

Arrays

When a string or number array is dimensioned in BASIC, a section of memory is used to represent it. The section comprises a header and then groups of 5 byte descriptors. This is true for either number or string arrays. In the former the 5 bytes contain the array element value; in strings, the length and pointer to the string.

The header provides general details of the array. In the order of storage, the header contains:

Byte 1 = First letter of name
Byte 2 = Second letter of name (+128 if a string array)

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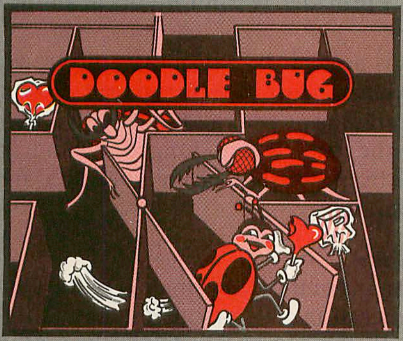

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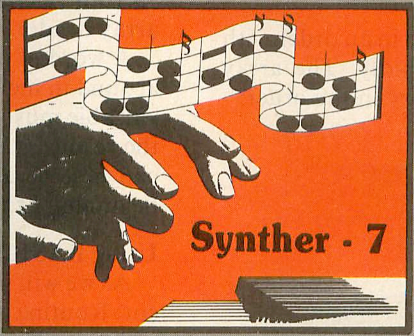

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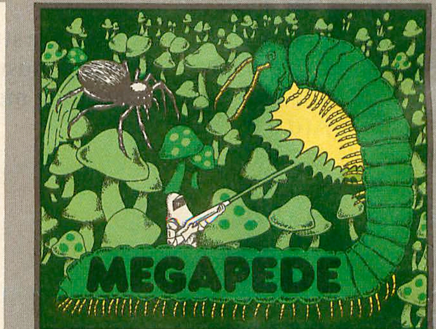

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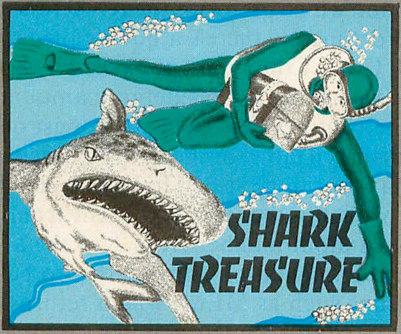
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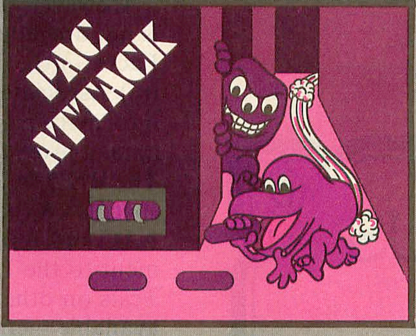

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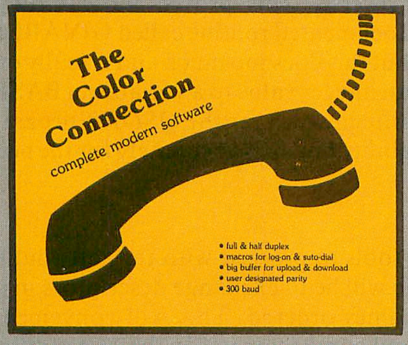
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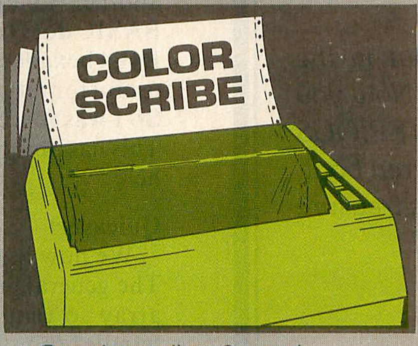
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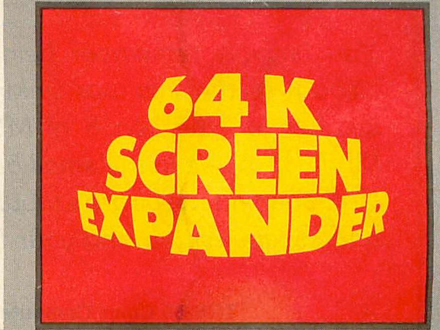
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Byte 3 & 4 = 16 bit count of total bytes used by the array, including the header
Byte 5 = Number of dimensions
Byte 6 & 7 = 16 bit count of elements in last dimension
Byte 7 & 8 = Ditto for next to last dimension
Byte 9 & 10 = Ditto for first dimension
Byte *11* = First byte of 5 byte descriptor of "zeroth" element

This is for an array with 3 dimensions. If more or less, then more or less byte pairs are needed to detail the number of elements in each dimension. So it is immediately obvious that the number of bytes in the header is dependent upon the number of dimensions.

The elements of the array itself are stored in an order with the leftmost dimension varying most rapidly. The array A(3,2,1) will be stored in ascending memory in the order:

A(0,0,0)
A(1,0,0)
A(2,0,0)
A(3,0,0)
A(0,1,0)
A(1,1,0)
A(2,1,0)
A(3,1,0)
A(0,2,0)
A(1,2,0)
A(2,2,0)
A(3,2,0)
A(0,0,1)
A(1,0,1)
ETC.

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Knowing the address of the "zeroth" element thus enables us to locate any subscript descriptor in the array.

The *VARPTR* Function

Extended BASIC provides this function which returns the address of the variable descriptor supplied as its argument. This can be used to pass an array pointer from BASIC to a machine code routine. For example, the call X=USR (VARPTR(A(0,0))) will pass the address of the first byte of the 5 byte descriptor for that subscript variable. The machine code function INTCNV will put this value in register D of the microprocessor. Knowing the address of the "zeroth" element also provides us with the location of the array header.

A word of caution is needed! BASIC moves the variables around in memory when a new one is introduced. So a new variable must not be created after a call to VARPTR before the result is used, as the value will no longer be valid. This can best be avoided by pre-assigning the variables at the beginning of the program.

Using BASIC Functions

As we will see later, one of the requirements of the Quicksort Routine is the generation of a random number. Another is the conversion of a floating point number in the FAC to a 16 bit integer. The second requirement is already available through a routine documented in the BASIC manual. It is called INTCNV and its address is B3ED (hexadecimal).

However, the function which performs the RND function is not documented. Fortunately there's a book called "The Facts for the TRS-80 Color Computer" published by Spectral Associates, which provides a considerable amount of information about the routines in BASIC. Amongst other data, it provides the dispatch table for the BASIC functions. The RND function happens to be at BF1F (hexadecimal). I speculated that this probably took the argument from the FAC and returned a random number from 1 to the argument to the FAC. Experimentation showed this to be so. Tests on other functions such as MEM, which returns the available memory, worked in a similar manner.

With access to these functions, all that was required was a method of getting the FAC value into register D as a 16 bit integer (the INTCNV routine mentioned earlier), and another to do the reverse. This proved more difficult. BASIC does have a documented routine called GIVABF (at B4F4 hexadecimal) but this does too much and is really only useful for returning an integer value to a variable in BASIC. So I was forced to write my own for the *QSORT* program. This has limited capability but does adequately for the needs here.

Quicksort

We now have the tools to proceed with the sort routine. The general principle will be to exchange descriptors in the array so that it becomes ordered. This will conveniently handle both strings and number arrays. In the case of strings this has the advantage of making it unnecessary to move the actual strings themselves.

The Algorithm

Quicksort is a fast and simple process, but does entail considerable "housekeeping." To help follow it through, listing 1 shows its implementation in BASIC.

The general procedure involves the ordering of a partition. Initially the whole array is taken as a partition. An element is selected from this partition and designated the

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comparand. Then each element is compared with this, starting from the low end. When one is found which is equal to or greater than the comparand, its subscript is noted. The scan is then started from the high end, looking for an element which is equal or lower than the comparand. When one is found, it is swapped with the element found on the upward scan. This is only done however, if the upward scan element was originally below the downward scan one. If so, then the upward and downward scan continues from where it left off, performing similar swaps.

Eventually the selected element on the upward scan will not be below the one on the downward. At this point the selected elements will either be the same one, or the upward higher than the downward. The result is an array with all the elements below the upward scan selected element being equal or less than the comparand. All elements above the downward scan selected element will be equal to or higher than it.

The partition must now be split into two separate partitions. Then each partition has the same action peformed on it, until every partition is reduced to one element. When all partitions have been so reduced, the array is sorted.

The partition to be divided is split into one with all elements up to but not including the upward scan selected element. The other is made up of those elements from the downward scan, in a similar fashion. It is apparent from this that the data defining one partition must be saved while the other is further scanned. If the original array is limited to 4096 elements and the data on the larger of the two resulting partitions is saved while the other is scanned, then the dividing process cannot result in more than 12 lots of data being stored at any one time. This is due to the fact that 4096 cannot be divided by two more than 12 times before the result is unity. This is verified by the fact that 4096 is 2∧12.

This seemingly complex process is in fact extremely fast. Also its speed varies roughly linearly with number of elements. Bubble sort times, in contrast, increase as the square of the number of elements.

Selecting The Comparand

The comparand is ideally chosen so that there are approximately equal numbers of elements in the resulting two partitions. To obtain this a median value should be chosen, as this will have as many elements lower than it as higher. Unfortunately, the process of calculating median values is itself time consuming. To avoid this problem, the comparand element is chosen at random from the partition. With larger enough partitions, the average result will be satisfatory. However, when partitions become small, this is not so. To avoid this problem another simpler routine is used to sort the partition when it contains 10 or less elements. The routine used here is a form of bubble sort which I have called Easysort. It is simple in function and can be readily understood from the BASIC in listing 1. Experimentation showed about a 25 percent improvement in overall speed when this hybrid approach was used.

The BASIC Version

I chose to test my understanding of the algorithm by first implementing it in BASIC. Of course, there is nothing preventing the use of this in your BASIC programs. It is surpris-

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ingly quick, sorting 100 numbers in around 18 seconds. This is significantly faster than a bubble sort. Listing 1 is by way of a demonstration program. You select the size of the array to sort. It then generates a random number array and sorts it. A display is given of the time taken to sort and the number of times Easysort was called. The program is easily converted to sort strings by changing array "N" to "N$" throughout and modifying the random array filling routine.

The *Quicksort* routine itself is from line 200 through 990. Line 230 determines the size the partition below which Easysort is used. The Easysort routine is from line 1200 to the end. The remaining lines are involved with test set-up (10-140) and result display (1000-1120).

In the *Quicksort* routine the following variables perform these functions:

SIZE	sort array size
N	sorted array
LS	partition left end stack array
RS	partition right end stack array
B	current partition left end subscript
E	current partition right end subscript
LI	left scan pointer
RI	right scan pointer
PTR	partition stack pointer
LSZ	size of left section of split partition
RSZ	size of right section of split partition
CMP	subscript of selected random element

The *Quicksort* routine breaks down into various sections. These sections will generally be duplicated in the machine code version later. Lines 200-220 initialize the pointers. Line 230 selects either *Quicksort* or Easysort, depending on the size of the partition. Lines 300-380 determines which side of the divided partition to stack. Also tests are done to ensure a remaining partition has something in it.

The left and right stacking is performed by lines 750-810 and lines 850-910 respectively. Line 380 checks to see if the stack is empty. If so, the sorting is complete. If not, then lines 950-990 unstack the next partition for sorting. Line 500 selects the comparand at random. Lines 550-570 scan upward and 600-620 scan down. Finally line 700 tests the scan pointer for crossing. If not, the elements are swapped; if so, the scanning stops.

Armed with this information it should be easy to follow the operation of both *Quicksort* and *Easysort*.

The next issue will wrap this up with the complete assembly language listing and details on the features and uses of the routine.

200 0108
600 0265
1000 . . . 03C5
END . . . 0593

The listing:

```
10 INPUT"ARRAY SIZE";SIZE
20 IF SIZE=0 THEN END
30 IF SIZE>4095 THEN 10
40 INPUT"RESULTS TO PRINTER";A$
50 IF A$="Y" THEN DV=-2 ELSE DV=
0
60 DIM N(SIZE),LS(12),RS(12)
70 FOR I=0 TO SIZE
80 N(I)=RND(1000)
```

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```
90 NEXT I
100 PRINT"SORT BEGINS"
110 TIMER=0
120 GOSUB 200
130 GOSUB 1000
140 RUN
200 B=0:E=SIZE
210 LI=0:RI=SIZE
220 PTR=0
230 IF E-B>10THEN GOSUB 500ELSE
GOSUB 1200:GOTO380
300 LSZ=(LI-1)-B
310 RSZ=E-(RI+1)
320 IF LSZ=RSZ THEN 350
330 IF LSZ>RSZ GOSUB 750 ELSE GO
SUB 850
340 GOTO 370
350 IF LSZ<=0 THEN 380
360 GOSUB 760
370 IF(E-B)<=0THEN 380 ELSE 230
380 IF (PTR)=0 THEN RETURN
390 GOSUB 950
400 GOTO 230
500 CMP=N(RND(E-B+1)+B-1)
550 FOR LI=LI TO E
560 IF N(LI)=>CMP THEN 600
570 NEXT LI
600 FOR RI=RI TO B STEP-1
610 IF N(RI)<=CMP THEN 700
620 NEXT RI
700 IF LI<RI THEN T=N(LI):N(LI)=
N(RI):N(RI)=T:LI=LI+1:RI=RI-1:GO
TO550
710 RETURN
750 IF LSZ<=0THEN 790
760 LS(PTR)=B
770 RS(PTR)=LI-1
780 PTR=PTR+1
790 B=RI+1
800 RI=E
810 RETURN
850 IF RSZ<=0 THEN 890
860 LS(PTR)=RI+1
870 RS(PTR)=E
880 PTR=PTR+1
890 E=LI-1
900 LI=B
910 RETURN
950 PTR=PTR-1
960 B=LS(PTR)
970 E=RS(PTR)
980 LI=B:RI=E
990 RETURN
1000 T=TIMER
1010 PRINT#DV,STRING$(30,"*")
1020 PRINT#DV,"ARRAY SIZE WAS ";
SIZE
1030 PRINT#DV,USING"SORT TIME WA
S ###.## SECONDS";T/60
1040 PRINT#DV,"CALLS TO EASISORT
=";CL
1050 FOR I=0 TO SIZE-1
1060 IF N(I)>N(I+1) THEN 1100
1070 NEXT I
1080 PRINT#DV,"SORT WAS SUCCESSF
UL"
1090 GOTO 1110
1100 PRINT#DV,"SORT WAS UNSUCCES
SFUL"
1110 PRINT#DV,STRING$(30,"*")
1120 RETURN
1200 K=B
1210 CL=CL+1
1220 K=K+1
1230 IF K>E THENRETURN
1240 IF N(K)>=N(K-1) THEN1220
1250 TN=N(K)
1260 I=K
1270 N(I)=N(I-1)
1280 I=I-1
1290 IF I=B THEN 1310
1300 IF TN<N(I-1)THEN 1270
1310 N(I)=TN
1320 GOTO 1220
```

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A WORD FROM THE SPONSOR

Number five in these chats, and it is still too early to judge the results in our *Name the Column* contest. But I have received some excellent entries, and will have the winner next month. Stay tuned.

At this point, I'd like to thank a few more magazines for giving our products great reviews in the past few months — in March, Color Computer News reviewed NEWTALK and Rainbow reviewed REMOTERM, while in April 80 Micro reviewed STAR-DOS. They all loved them . . . naturally.

This month I thought you might be interested in some of my cassette procedures.

While a number of outfits make leaderless computer cassettes, I distrust them. From my audio days, I know that the beginning and end of a reel-to-reel or cassette tape tend to get crinkled and develop dropouts. This can destroy a program copy, and so I wouldn't use the beginning of a leaderless tape anyway. In that case, why pay extra for leaderless tape when you don't use it?

Instead, I buy 10-minute C-10 cassettes. These cassettes are available from a variety of sources, and cost about 50 to 80 cents each. I prefer to use one cassette per program, rather than put many programs on one tape and then have to search for them.

All of these tapes have a leader, and so when you use them you must be careful not to record your program on the leader instead of the tape. Using fast forward to get past the leader may leave a bit of an old program on the tape just before the new one, and CoCo will have trouble separating them. Instead, my method is to do the following: First, make sure the tape is fully rewound. Then place the recorder in RECORD, and type the command MOTOR ON on the computer. This starts the recorder motor, so that you are recording although the computer is not yet writing anything to tape. This erases the beginning of the tape. In the meantime, type your CSAVE or CSAVEM command, but do not hit ENTER until you see that the tape is well past the leader. I usually give it about ten seconds before typing ENTER. This procedure not only makes sure that I get past the leader, but also guarantees that there is blank space before the program to make reading it easier. Works every time.

For the disk users among you, I would like to announce two new products: STAR-DOS 64 and STAR FLEX. Both are disk operating systems for 64K computers. STAR FLEX is the famous FLEX system by Technical Systems Consultants, adapted for the CoCo, while STAR-DOS 64 is our own STAR-DOS, but modified for 64K computers. Both come with high resolution screens and have many features for the more advanced disk user. STAR FLEX is, of course, compatible with the large amount of software developed over the years for FLEX systems. STAR-DOS 64 will also run much of that software, but its big advantage (besides the fact that it is cheaper) is that its disk format is the same as Radio Shack's.

If you do not have a 64K system, then by all means consider the original STAR-DOS. The upgrade from STAR-DOS to STAR-DOS 64 is just the price difference between the two, so you can upgrade at any time. (But before getting any DOS for your CoCo, read our February advertisement!)

That's it for this month. Until June, just remember: *On a Clear Disk, You Can Seek Forever.*

Peter Stark

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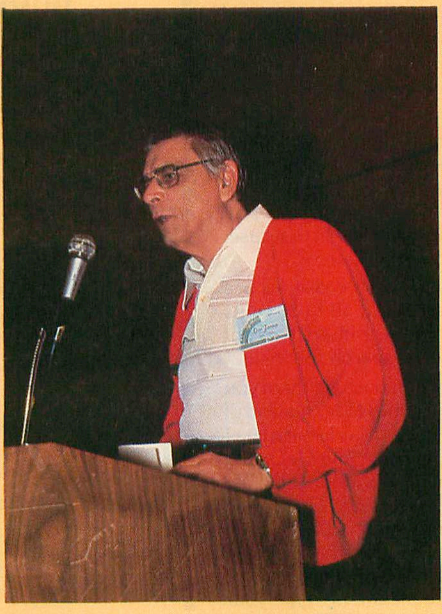
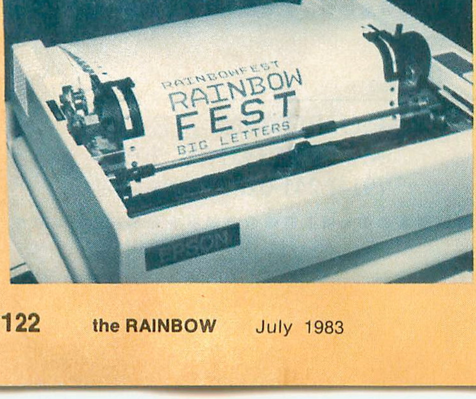


Had a wonderful time. Wish you were there. Fact is, several thousand of us *were* at RAINBOWfest and, by all accounts, it was a huge success. From Don Inman's insightful breakfast address to the informative seminars by Fred Scerbo, Dr. Hal Snyder, Charlie Roslund, E. R. Bailey, Lonnie Falk, Tom Nelson and Steve Bjork, to all the activities in the crowded Mayoral Ballroom exhibit hall, CoCo's very first show was a time to learn, a time to explore and, perhaps most of all, a time to meet people. When will the next one be, and where? Stay tuned. We don't think we can wait a year.



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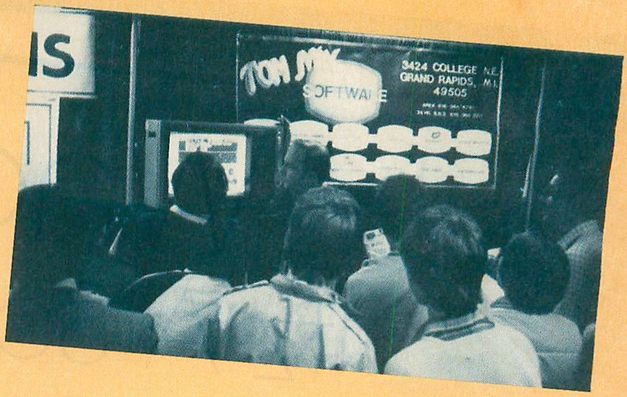
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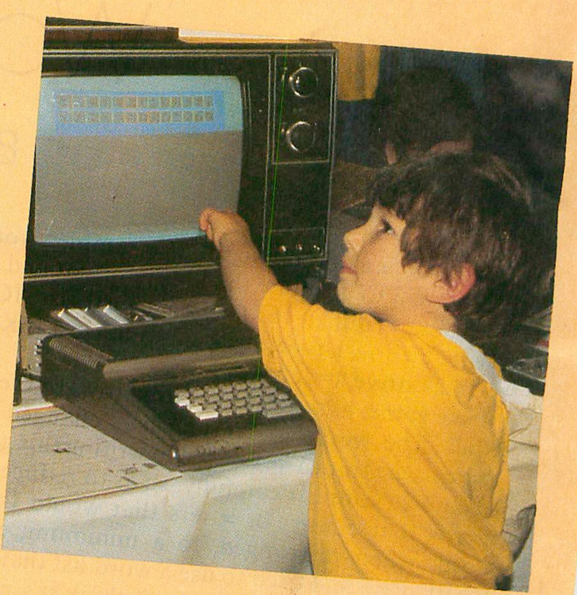

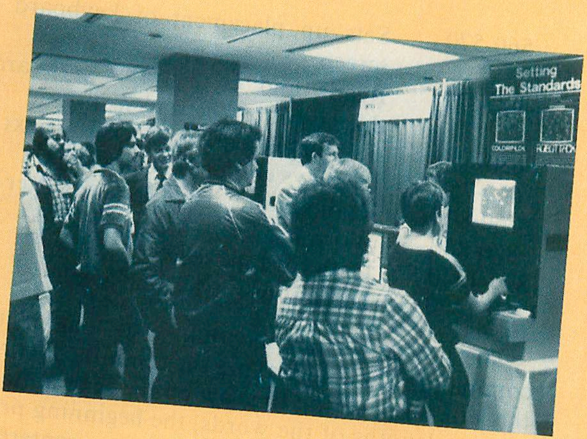
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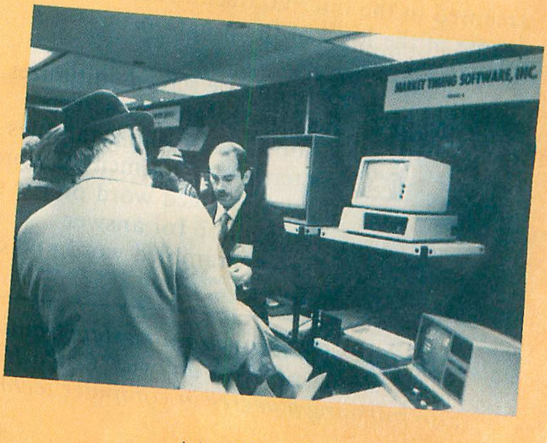
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Whatzit? Itz A Scrambled Word Game

By Randall Smith

Whatzit is a one or two player scrambled word game using *PMODE* 3 to generate the screen format and character set. The game requires 16K and Extended BASIC. I'm sorry to say that it doesn't seem to want to run in a 16K machine with the disk drive attached.

The game, as written, is geared toward the older child or adult. The word list can be easily changed to fit any age group. One thing I've noticed in writing this game is the need to choose your list carefully, so as to reduce the number of words that consist of letters that would form a different word, when rearranged, to a minimum; e.g. BAT-TAB, KEEP-PEEK. I tried to use a word list that kept this problem to a minimum, but I don't think it's possible to completely eliminate the problem. The word list contains 232 words. If you change it to a different number of words, the contents of lines 90 and 270 will have to be changed to match the number of words used.

On running the program you are greeted with options to see the directions or bypass them, and to choose the number of players. The input is error trapped throughout, and screen and sound prompts will guide you through the game.

The score given for each correct guess is a result of the formula in line 630 and is a function of both the time required and length of the word. You are given approximately 30 seconds to enter the correct answer. If you mistype a letter the entry can be erased and started over by pressing the left arrow key. If you fail to guess the word the correct response will be displayed at the expiration of time.

Enough about the playing directions; they're well-documented in the internal documentation. Let's take a look at some of the logic of the program:

LINES	
10-140	Sets up title screen, initializes variables
150-260	Sets up the graphic screen
270-370	Chooses word and scrambles it
380	Determines placement of word on the screen
390-420	Puts scrambled word on the screen
430-490	Timing loop for answer
500-550	Erases scrambled word and displays correct answer
560-570	Sets up placement of keyboard entry on screen
580-620	Reads and error traps keyboard entries, displays it on the screen
630-650	Calculates score and gets the next word
660-750	Displays end of game message
760-820	Updates and displays scores after each word
830-880	Word list
890-1240	Data for font set
1250-1320	Directions for playing game

The use of an incrementing scale value in the *DRAW* command, when displaying the scrambled word, results in the letters appearing to grow on the screen. Because of the varying lengths of the words, the beginning point for each word had to be figured to keep them centered. This was accomplished by the formula in line 560. The algorithm to scramble the word is in lines 280-340. Each word is checked in line 340 to be sure it is scrambled.

The font set used to generate the characters in the game is of my own design and is made with a 5 x 7 matrix. I tried to make it resemble the screen character set as much as possible. The font set can be utilized in your own programs by deleting all the lines in this program except lines 890-1240. These lines can then be saved to tape or disk and loaded back in memory before you begin writing the program. The size of the characters can be controlled by use of the scale factor in the *DRAW* command.

Clearing the screen of the previous entries was done by using the *PAINT* command to fill in the box at the bottom of the screen with the background color. This method works well if you are clearing out an area completely enclosed by the same color. To clear out the center of the screen it was necessary to use the *LINE, BF* command with the background color. These methods are both utilized in line 640.

I feel the program is quite flexible for different situations. By customizing the word list it can be made suitable for all age groups or for special occasions like bridal or baby showers or to challenge people in different vocabulary areas; such as specialized technical field words, states, countries—well, you get the idea. We've played with it for over a year and I hope you get as much enjoyment out of it as we have. If you get a score of 8000 or greater you've done *real* well. So, get those thinking caps on and let's play *Whatzit!*

(Mr. Smith is a supervisor at a state training center for retarded citizens. He is an avid "CoCo Hacker" and is also pursuing a degree in computer technology.)

130	0271	830	0EC7
240	04BF	870	12A2
410	074B	960	1513
590	097F	1110	1754
680	0BAA	1250	1A0C
		END	1D00

The listing:

```
10 '***WHATZIT A WORD GAME***
20 '***BY RANDALL A. SMITH***
30 'IF YOU CHANGE OR ADD TO THE
40 'WORD LIST, YOU WILL HAVE TO
50 'DETERMINE HOW MANY WORDS YOU
60 'HAVE AND ADJUST THE COUNT IN
70 'LINES 90 & 270 ACCORDINGLY
80 CLS:SOUND200,1:PCLEAR4:PMODE3
,1:PCLSRND(4):SCREEN1,RND(2)-1:C
LEAR350:DIM CH$(35),U(10),B(12),
SC$(2):T=RND(-TIMER)
90 FOR X=1 TO 232:READ X$:NEXT:F
OR X=0 TO 35:READ CH$(X):NEXT:RE
STORE
100 SOUND200,2:FORX=1024 TO 1055
:POKEX,134:NEXT:FORX=1056 TO 147
2 STEP32:POKEX,134:POKEX+31,134:
NEXT:FORX=1504 TO 1535:POKEX,134
:NEXT
110 PRINT@225,"DO YOU WANT INSTR
UCTIONS(Y/N)?";
115 PRINT@170,"w h a t z i t";
120 IN$=INKEY$:IF IN$="Y"THEN GO
SUB1250 ELSE IF IN$=""THEN 120
130 PRINT@225,"  HOW MANY PLAYER
S (1 OR 2)? ";
140 PL$=INKEY$:IF PL$<>"1" AND P
L$<>"2" THEN 140 ELSE PL=VAL(PL$
):SOUND200,1
150 PCLS:DRAW"BM0,12;C8;S8"+CH$(
30)+CH$(25):GET(0,0)-(28,14),U,G
:GET(128,96)-(156,110),B
160 PCLS:DRAW"BM83,12;S8;C7"+CH$
(32)+CH$(17)+CH$(10)
170 DRAW CH$(29)+CH$(35)+CH$(18)
+CH$(29)
180 DRAW"BM0,30"+CH$(25)+CH$(21)
+CH$(10)
190 DRAW CH$(34)+CH$(14)+CH$(27)
+CH$(1)
200 DRAW"BM0,48"+CH$(28)+CH$(12)
+CH$(24)+CH$(27)+CH$(14):COLOR8,
5:LINE(69,33)-(126,51),PSET,B
210 IF PL=1 THEN 240 ELSE COLOR7
,5:DRAW"BM163,30"+CH$(25)+CH$(21
)+CH$(10)
220 DRAW CH$(34)+CH$(14)+CH$(27)
+CH$(2)
230 DRAW"BM191,48"+CH$(28)+CH$(1
2)+CH$(24)+CH$(27)+CH$(14):COLOR
8,5:LINE(128,33)-(185,51),PSET,B
240 LINE(52,171)-(200,190),PSET,
B
250 IF PL=2 THEN LP=2:PL=PL-1
260 PUT(0,52)-(28,66),U,PSET:SCR
EEN1,1
270 FOR WORD=1 TO 10:FOR X=1 TO
RND(232):READ W$:NEXT X:RESTORE
280 L=LEN(W$)
290 W(1)=RND(L-1)+1
300 FOR X=2 TO L
310 W(X)=RND(L)
320 FOR XX=1 TO X-1:IF W(XX)=W(X
) THEN310 ELSE NEXT XX:NEXT X
330 FOR X=1 TO L:W$(W(X))=MID$(W
$,X,1):NEXT X
340 J$="":FOR X=1 TO L:J$=J$+W$(
X):NEXT X:IF J$=W$ THEN 290
350 DRAW"BM65,187;C6;S8"+CH$(17)
+CH$(18)+CH$(29)
360 DRAW"BM+10,+0"+CH$(14)+CH$(2
3)+CH$(29)+CH$(14)+CH$(27)
370 IF INKEY$<>CHR$(13) THEN 370
 ELSE PAINT(128,175),5,8
380 L=LEN(J$):M=INT(132-(21*(LEN
(J$)/2))-21)
390 FOR X=1 TO L:M=M+21:FOR S=1
TO10 STEP 3
400 DRAW"BM"+STR$(M)+",100;C6;S"
+STR$(S)+CH$(ASC(MID$(J$,X,1))-5
5)
410 PLAY"V31;T230;L230;O3;A":DRA
W"BM"+STR$(M)+",100;C5;S"+STR$(S
)+CH$(ASC(MID$(J$,X,1))-55)
```

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```
420 NEXT S:DRAW"BM"+STR$(M)+",10
0;C6;S12"+CH$(ASC(MID$(J$,X,1))-
55):NEXT X
430 T=2000
440 GOSUB560
450 T=T-1:IF T=0 THEN GOSUB470:G
OTO650
460 GOTO580
470 PLAY"T3;L3;V31;O1;B;L2;A"
480 PAINT(128,175),5,8
490 IF T>0 THEN GOSUB560:RETURN
500 LINE(0,79)-(255,100),PRESET,
BF
510 M=INT(132-(21*(LEN(J$)/2))-2
1)
520 FOR X=1 TO LEN(W$):M=M+21
530 DRAW"BM"+STR$(M)+",100;C8;S1
2"+CH$(ASC(MID$(W$,X,2))-55):NEX
T X
540 FOR X=1 TO 1000:NEXT:LINE(0,
79)-(255,100),PRESET,BF
550 RETURN
560 WW$="":M=INT(130-(14*LEN(W$)
/2))
570 DRAW"BM"+STR$(M)+",187;C6;S8
":RETURN
580 IN$=INKEY$: IF IN$=""THEN GO
TO450
590 IF ASC(IN$)=8 THEN WW$="":GO
TO 610 ELSE IF ASC(IN$)=13 THEN
```

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```
620 ELSE IF ASC(IN$)<65 OR ASC(I
N$)>90 THEN GOTO450
600 IF LEN(WW$)=LEN(W$) THEN 450
 ELSE DRAW CH$(ASC(IN$)-55):WW$=
WW$+IN$:GOTO450
610 PAINT(128,175),5,8:GOSUB560:
GOTO450
620 IF WW$=W$ THEN PLAY"V31;L10;
T100;O3;A;B;C;D;E;F;G" ELSE GOSU
B470:IF T>0 THEN 450 ELSE GOTO65
0
630 SC$(PL)=STR$((INT((LEN(W$)*3
0)+T/2.86))+VAL(SC$(PL))):GOSUB7
60
640 FOR X=1 TO 500:NEXT:LINE(0,7
9)-(255,100),PRESET,BF:PAINT(128
,175),5,8
650 NEXT WORD:IF LP=2 THEN PL=PL
+1:LP=0:PUT(0,52)-(28,66),B:PUT(
227,52)-(255,66),U,PSET:PLAY"T3;
L3;O3;V31;G;L3;O2;G":GOTO270
660 IF PL=2 THEN PUT(227,52)-(25
5,66),B ELSE PUT(0,52)-(28,66),B
670 DRAW"BM13,100;C7;S16"+CH$(16
)+CH$(10)+CH$(22)+CH$(14)
680 DRAW"BM145,100"+CH$(24)+CH$(
31)+CH$(14)+CH$(27)
690 DRAW"BM65,187;C6;S8"+CH$(17)
+CH$(18)+CH$(29)
700 DRAW"BM+10,+0"+CH$(14)+CH$(2
3)+CH$(29)+CH$(14)+CH$(27)
710 IF VAL(SC$(1))>VAL(SC$(2)) T
HEN DRAW"BM107,25" ELSE DRAW"BM1
49,25"
720 DRAW"S4;C8;NU5;NE5;NR5;NF5;N
D5;NG5;NL5;NH5":FOR X=1 TO 100:N
EXT
730 DRAW"C5;NU5;NE5;NR5;NF5;ND5;
NG5;NL5;NH5":FOR X=1TO100:NEXT
740 IF INKEY$<>CHR$(13) THEN 720
750 SC$(1)="0":SC$(2)="0":SCREEN
0,0:GOTO130
760 L=LEN(SC$(PL))-1:ON PL GOTO7
70,780
770 PAINT(98,36),5,8:M=INT(101-(
14*L/2)-14):GOTO790
780 PAINT(158,36),5,8:M=INT(160-
(14*L/2)-14)
790 FOR SC=2 TO L+1:M=M+14:DRAW"
BM"+STR$(M)+",48;C6;S8"
800 DRAW CH$(ASC(MID$(SC$(PL),SC
,1))-48)
810 NEXT SC
820 RETURN
830 DATA SIRLOIN,HELP,ASSIST,DON
E,REMEMBER,WORK,LADY,NAME,PROGRA
M,NUMBER,CIGAR,GRAPH,DISH,MOTOR,
ENGINE,BODY,AUTOMOBILE,TRUCK,SWE
EP,LAMP,LIGHT,DISPLAY,RECIPE,AUT
OMATIC,FEATURE,ADVENTURE,CONTEST
```

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,MEMORY,QUICK,MACHINE,ANNUAL,HUN
DRED,THOUSAND,SUGAR,BECAU
840 DATA BOOK,PAPER,AUTHOR,COAL,
FUEL,STOVE,BUCKET,PAIL,LAZY,QUIT
,CHURCH,CHAPEL,STAR,SHIP,COMET,P
LANET,ROCK,ROCKET,INDEX,EQUAL,EV
EN,SAIL,SHELL,OYSTER,LOBSTER,PLE
ASE,RELEASE,EDITOR,WRITE,POWERFU
L,SCREEN,ALLOW,SAMPLE,THROUGH,MA
NY,PURSUE,EACH,COPY,BOMB
850 DATA FACE,NOSE,CHEEK,BONE,FA
T,MUSIC,TELEVISION,RADIO,LAW,SEN
IOR,JUNIOR,FRESH,SCHOOL,LIFT,RAI
SE,LOWER,MEDIUM,PLAIN,HILL,FARME
R,RANCH,WING,SOME,OTHER,BELIEVE,
THIS,JUST,WILD,MOTHER,FATHER,UNC
LE,AUNT,SHOCK,EXACT,GENEROUS,BRO
WN,BLUE,GREEN,PURPLE,EIGH
860 DATA INDIAN,STATE,COUNTRY,TH
AT,POLICE,PECAN,WALNUT,BROOM,SAG
E,PEPPER,MALT,DRUG,STAMP,ENVELOP
E,HEAT,CLEAN,DIRTY,CARPET,SOFA,C
OUCH,TABLE,FLOWER,SHACK,LOOK,SHO
E,PANTS,DRESS,SHIRT,SOCK,MITTEN,
GLOVE,STRANGE,CITY,TOWN,BRIGHT,B
EAUTIFUL,NOVEL,SWING,FORM
870 DATA CABINET,DRIFT,FLOAT,PRE
TEND,AUDIO,DOCTOR,DENTIST,NURSE,
RENT,LEASE,SKILLET,BROIL,BAKE,FR
Y,HAMMER,MOVE,CHICKEN,DUCK,GOOSE
,HORSE,PONY,COLT,KNIGHT,RIDE,PAN
,POT,MORTGAGE,PRETEND,PLAY,TENT,
KNOW,TEACH,DRINK,DARK,VOICE,HOTE
L,MOTEL,INTIMATE,STORY,ST
880 DATA SIZE,CENTER,FORWARD,GUA
RD,TACKLE,GOAL,BACK,GROUND,PRESE
NT,GIFT,LOCKER,CIRCLE,FLOWER,CRY
STAL,JEWEL,COFFEE,FLEA,CRIME,MUR
DER,HOLD,UGLY,PRETTY,MILD,GENTLE
,HAMMER,BALL,THEIR,THEY,WERE,GIR
L,WARM,SOFT,YIELD,CREATURE,FAST,
SLOW,EVERYONE,SUCH,END
890 DATA "BU1;U4;E1;R2;F1;D4;G1;
L2;H1;BD1;M+4,-6;BD6;BR3"
900 DATA "BU5;BR1;E1;D6;NL1;R1;B
M+4,+0"
910 DATA "NR4;U1;BU3;U1;E1;R2;F1
;D1;G1;L1;G2;BM+7,+1"
920 DATA "BU5;E1;R2;F1;D1;G1;NL2
;F1;D1;G1;L2;NH1;BM+7,+0"
930 DATA "BU3;NR4;M+3,-3;D6;BM+4
,+0"
940 DATA "BU4;NR3;U2;R4;BD2;BL1;
F1;D2;G1;L2;H1;BM+7,+1"
950 DATA "BU6;BR3;NF1;L2;G1;D2;N
R3;D2;F1;R2;E1;U1;H1;BM+4,+3"
960 DATA "U1;BU5;R4;D1;M-4,+4;BM
+7,+1"
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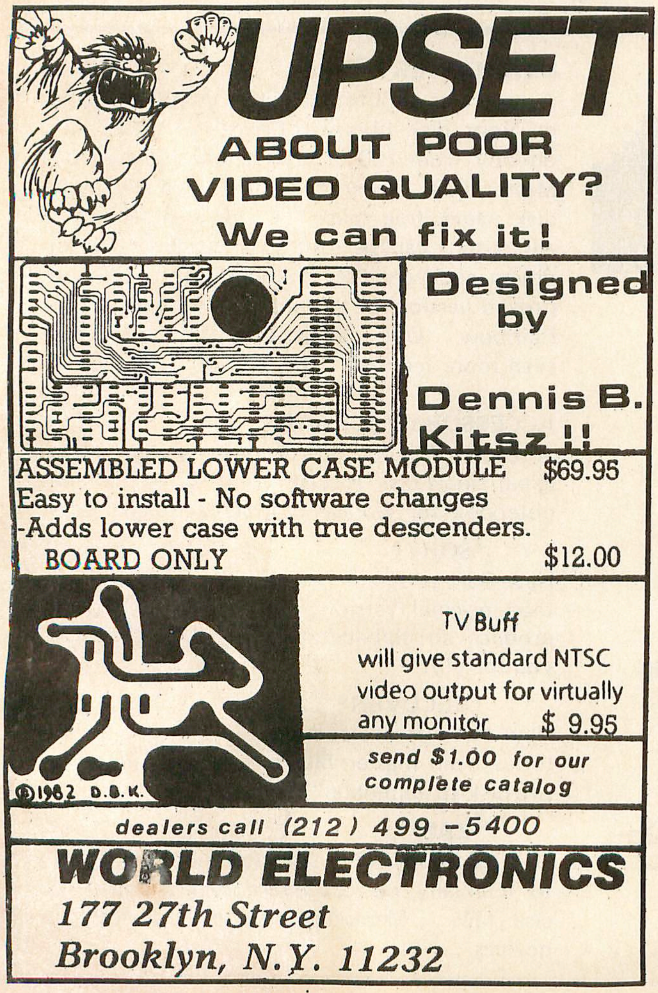
```
970 DATA "BU1;U1;E1;R2;E1;U1;H1;
L2;G1;D1;F1;R2;F1;D1;G1;L2;H1;BM
+7,+1"
980 DATA "BU1;F1;R2;E1;U4;H1;L2;
G1;D1;F1;R3;BM+3,+3"
990 DATA "U5;E1;R2;F1;D3;NL4;D2;
BR3"
1000 DATA "U6;R3;F1;D1;G1;NL3;F1
;D1;G1;L3;BR7"
1010 DATA "BU1;U4;E1;R2;F1;BD4;G
1;L2;H1;BR7;BD1"
1020 DATA "R1;U6;NL1;R2;F1;D4;G1
;L2;BR6"
1030 DATA "U3;NR3;U3;R4;BD6;L4;B
R7"
1040 DATA "U3;NR3;U3;R4;BD6;BR3"
1050 DATA "BU1;U4;E1;R3;BD4;NL1;
D2;L3;H1;BR7;BD1"
1060 DATA "U3;NR4;U3;BR4;D6;BR3"
1070 DATA "BU6;BR1;R1;ND6;R1;BR1
;BD6;BL1;L2;BR6"
1080 DATA "BU2;D1;F1;R2;E1;U5;BD
6;BR3"
1090 DATA "U6;BR4;M-4,+3;M+4,+3;
BR3"
1100 DATA "NU6;R4;BR3"
1110 DATA "U6;M+2,+3;M+2,-3;D6;B
R3"
```



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```
1120 DATA "U6;M+4,+6;U6;BD6;BR3"
1130 DATA "U6;R4;D6;L4;BR7"
1140 DATA "U6;R3;F1;D1;G1;L3;D3;
BR7"
1150 DATA "BU1;U4;E1;R2;F1;D4;G1
;L2;H1;BE1;BR1;F2;BR3"
1160 DATA "U6;R3;F1;D1;G1;L3;R1;
M+3,+3;BR3"
1170 DATA "BU1;F1;R2;E1;U1;BU3;H
1;L2;G1;D1;M+4,+2;BR3;BD2"
1180 DATA "BU6;R2;ND6;R2;BD6;BR3
"
1190 DATA "BU1;U5;BR4;D5;G1;L2;H
1;BD1;BR7"
1200 DATA "BU6;M+2,+6;M+2,-6;BD6
;BR3"
1210 DATA "U6;BR4;D6;M-2,-2;NU1;
M-2,+2;BR7"
1220 DATA "U1;M+4,-4;U1;BL4;D1;M
+4,+4;D1;BR3"
1230 DATA "BR2;U3;M-2,-2;U1;BR4;
D1;M-2,+2;BD3;BR5"
1240 DATA "BU6;R4;M-4,+6;R4;BR3"
1250 CLS:PRINT:PRINT"    IN whatz
it  A SCRAMBLED GROUPOF LETTERS
WILL APPEAR. YOU WILLHAVE APPROX
IMATELY THIRTY SEC-  ONDS IN WHI
CH TO FIGURE OUT THE CORRECT WOR
D THESE LETTERS FORM AND ENTER T
HEM ON THE KEYBOARD."
1260 PRINT"IF YOU MAKE A TYPING
ERROR, YOU MAY HIT THE '_' KEY A
ND START   OVER. IF YOU <ENTER>
THE WRONG  ANSWER, IT WILL BE ER
ASED AND   YOU MAY RE-ENTER IT A
S TIME AL-"
1270 PRINT"LOWS. THE GAME MAY BE
 PLAYED BY EITHER ONE OR TWO PEO
PLE.":PRINT:PRINT"    HIT ANY KE
Y TO CONTINUE";
1280 IF INKEY$=""THEN 1280
1290 CLS:PRINT:PRINT"   EACH PLA
YER GETS TEN RANDOM- LY CHOSEN W
ORDS IN EACH ROUND.  YOUR SCORE
IS BASED ON BOTH THE AMOUNT OF T
IME YOU USE AND THE  LENGTH OF T
HE SCRAMBLED WORD."
1300 PRINT"PLEASE NOTE THAT YOUR
 ANSWER IS NOT COMPLETE UNTIL YO
U PRESS    <ENTER>. THE TIMER DO
ES NOT     START UNTIL ALL THE S
CRAMBLED   LETTERS ARE ON THE SC
REEN. FOL- LOW THE PROMPTS AS TH
EY APPEAR  ON THE SCREEN AND GOO
D LUCK!!"
1310 PRINT:PRINT" HIT ANY KEY TO
 BEGIN THE GAME"
1320 IF INKEY$=""THEN 1320 ELSE
CLSRND(8):GOTO130
```

platinum software

WORKSAVER RECEIVES RAVE REVIEWS

FROM COLOR COMPUTER NEWS AND RAINBOW

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- Fast Entry of Basic Programs
- Over 100 user definable keys
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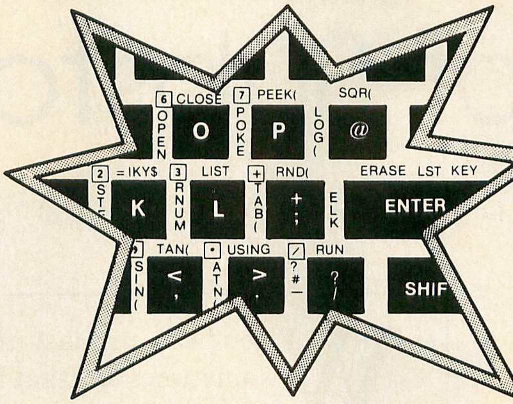

"There are a number of products on the Coco market...the WORKSAVER ranks up there with the best of them"
—Rainbow Dec. '82

"...undoubtedly the best program I have ever bought for my color computer"
—Color Computer News Jan. '83

"the main function of the program seems to be making things easier and more functional for the user. It succeeds extremely well"
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THE WORKSAVER WILL SAVE YOU HOURS OF WORK...WRITING AND DEBUGGING YOUR PROGRAMS"
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"The things that this program add to the color computer...

INCREASE ITS CAPABILITIES MANIFOLD

...it should have been incorporated into the original MICROSOFT programming (or) given out with every color computer."
—Color Computer News Jan '83

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- *Loads in seconds, takes 2.2 K*

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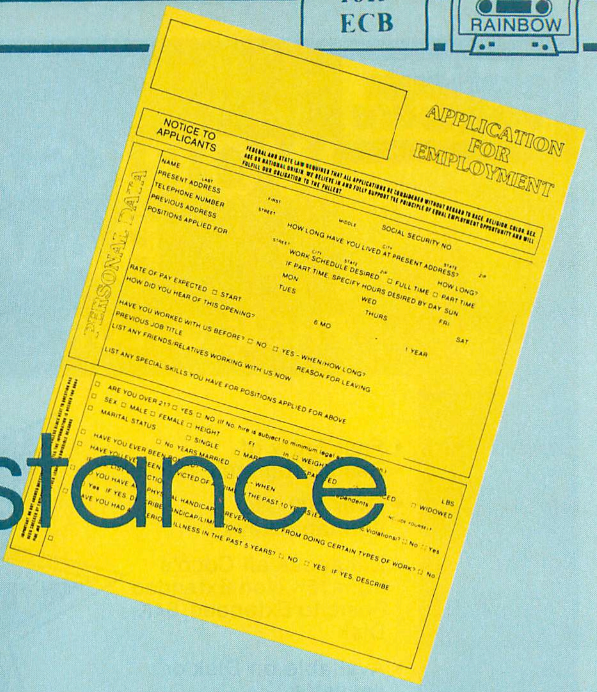
"A well designed keyboard overlay (NOT a sticker..."
—Color Computer News Jan. '83

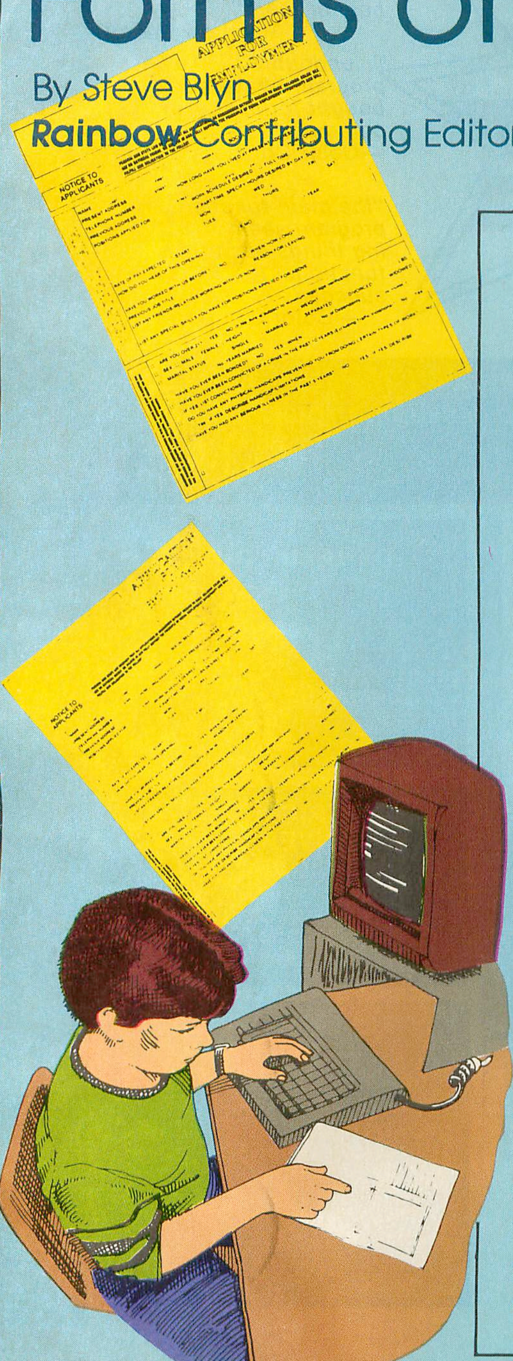
EDUCATION NOTES

16K
ECB

Learning To Create Forms of Substance

By Steve Blyn
Rainbow Contributing Editor


APPLICATION FOR EMPLOYMENT
NOTICE TO APPLICANTS
PERSONAL DATA
NAME
PRESENT ADDRESS
TELEPHONE NUMBER
PREVIOUS ADDRESS
POSITIONS APPLIED FOR


APPLICATION FOR EMPLOYMENT
NOTICE TO APPLICANTS

When was the last time you filled out a form? I sometimes feel that I am constantly asked to fill out a form of one kind or another.

A surprising number of students are unable to independently complete many forms and applications. In a world full of forms, it is essential to have the ability to fill them out properly. Too often, mistakes are made by handlers of these forms even after we have completed them correctly. Let's at least learn to do our part right.

We have all had experiences filling out charge, employment, school, social security, motor vehicle, bank account, health insurance, and innumerable other forms and applications. Yet, this is not a subject often taught in our schools. It really should be taught as part of a "survival education" or "life preparation" course. Too frequently, children encounter these legalistic looking papers for the first time when they actually have to fill them out for a real purpose.

This month's program offers practice and some teaching of a few of the common elements of applications. It is by no means a comprehensive course in filling out forms. It is merely a start on this path.

You may be surprised to find which items confuse certain children. I am constantly surprised by this. My own 10 year old was totally baffled on whether his borough or city should go into the "city" space. (The borough is usually the expected correct response in New York City.) Many children who are well aware of the answer are confused about exactly how they should enter their date of birth. Don't be surprised when unusual answers occur. A common answer to the questions of "sex" for many children is "yes" or "no" rather than "male" or "female." This is the time and place for the kids to learn the correct responses.

Much effort went into anticipating the various possible mistakes that children may make on the individual items. For example, line 250 will automatically insert a comma after the name of the city. Lines 310 and 340 will similarly place parentheses around the area code in a telephone number.

Some items on applications have variable lengths. As much room as possible was left to accommodate names of persons and cities. Other items, however, have definite lengths. This program coaxes the child to use only the correct number of entries. For example, the U.S. Post Office has two letter abbreviations for all of the 50 states. No periods are used anymore. Line 260 checks to see if two letters were used for the state's entry. If other than two letters are used, the program goes to line 520 where the message "all states use two letters" is flashed. Then the child is always given another chance to enter the item correctly. Area codes, zip codes, and telephone numbers have similar error trapping and messages. Of course, if you live in an area that has different rules, then change the values in the appropriate places to reflect your needs.

Most applications expect two digit answers for data of birth questions. February 20, 1960, usually appears as 02/20/60. This program reinforces the use of two digits and checks on lines 430 and 450 for improper month or date entries. Line 630 prints the error message for these responses.

After the last entry is completed, the message "your application is accepted" is scrolled across the bottom of the screen. Other possible items that you may wish to include in an enlarged version are sex, date, height, weight, hair and eye color, references, etc.

We welcome your comments as well as the opinion of any youngsters who make use of this program. Let's hear from you.

(Mr. Blyn, who teaches both exceptional and gifted children, holds two Master's degrees in the field of education and has won an award for the design of a computer program to aid handicapped children. He and his wife, Cheryl, own Computer Island.)

The listing:

	430..... 0590
120..... 01B9	560..... 0858
260..... 036C	END .. 0AC7

```
10 REM*STEVE BLYN,COMPUTER ISLAN
D
20 CLEAR500
30 CLS:PRINT@96,"DO YOU HAVE A P
RINTER TURNED ON":INPUT PR$:IF L
EFT$(PR$,1)="Y" THEN PR=1
40 POKE359,57:SCREEN0,1: REM****
*LET'S USE A DIFFERENT COLORED
SCREEN FOR A WELCOME CHANGE
50 CLS
60 PRINT@6,"*application form*";
70 PRINT@32,"NAME:";
80 PRINT@69,"-------------  ----
---------";
90 PRINT@102,"LAST          FI
RST";
100 PRINT@37,"";:LINE INPUTL$:SO
```

Spellbinding?

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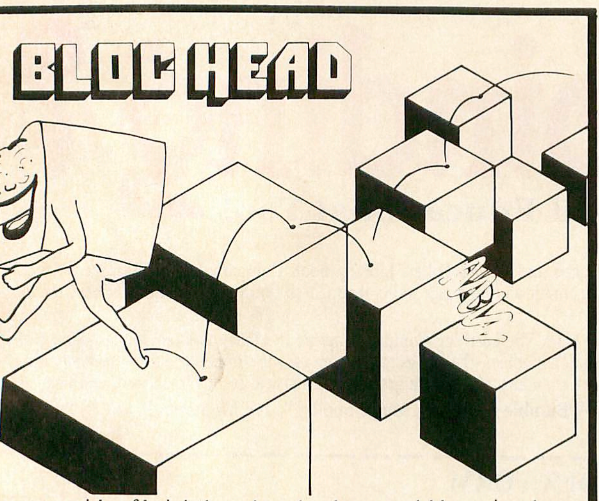
```
UND170,3
110 PRINT@52," ":PRINT@52,"";:LI
NE INPUTF$:SOUND200,3
120 PRINT@64," ":PRINT@96," ":'*
**REMOVES LAST AND FIRST
130 PRINT@96,"ADDRESS:";
140 PRINT@136,"-----------------
-------";
150 PRINT@169,"STREET AND NUMBER
";
160 PRINT@104,"";:LINEINPUTS$:SO
UND100,3
170 IF LEN(S$)>24 THEN PRINT@104
,LEFT$(S$,24)+"   "
180 PRINT@132," ":PRINT@160," "
190 GOSUB200:GOTO210
200 PRINT@160,"-----------------
------ -- -----";:RETURN
210 PRINTTAB(10)"CITY"TAB(22)"ST
ATE"TAB(28)"ZIP"
220 PRINT@128,"";:LINEINPUTC$:SO
UND125,3
230 CC=LEN(C$):IF CC>22 THEN PRI
NT@128," ":PRINT@128,LEFT$(C$,22
)
240 IFCC>22 THEN CC=22
250 PRINT@128+CC,",";
260 PRINT@152,"";:LINEINPUTST$:I
F LEN(ST$)<>2 THEN GOTO 520
```



The pyramids of brightly colored cubes would be a simple challenge for your little Bloc Head - IF it weren't for the dispicable characters after him, who try to push him off the cubes before he can change their colored surfaces! Bloc Head must dodge the sinister springs, bad eggs, & other evils. Luckily the good guys give him points and two elevators help him escape to the top of the pyramid, leaving the evil pursuers behind. Bloc Head knows that if he can just clear the pyramid of cubes, he goes to the next level of play, always adding up points.

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```
270 SOUND 150,3
280 PRINT@155,"";:LINEINPUT Z$:
IF LEN(Z$)<>5 THEN GOTO 530
290 SOUND 180,3
300 PRINT@160," ":PRINT@192," "
310 PRINT@192,"TELEPHONE #:(   )
"
320 PRINT@236,"----- --------";
330 PRINT@205,"";:LINEINPUTT$:IF
LEN(T$)<>3 THEN 540
340 PRINT@208,")";
350 PRINT@210," ":PRINT@210,"";:
LINE INPUT TT$:IFLEN(TT$)<>8 THE
N 550
360 IF MID$(TT$,4,1)<>"-"THEN 55
0
370 PRINT@224," ":PRINT@256,"AGE
:";:PRINT@292,"--";
380 PRINT@260," ":PRINT@260,"";:
LINEINPUTAG$
390 IF VAL(AG$)<1 OR VAL(AG$)>99
 THEN GOTO 560
400 PRINT@264,"DATE OF BIRTH:";:
PRINT@310,"-- -- --";
410 PRINT@342,"MO.DA.YR.";
420 NN=12:PRINT@278," ":PRINT@27
8,"";:LINEINPUTMO$:IFLEN(MO$)<>2
 THEN GOTO 570
430 IF VAL(MO$)<0 OR VAL(MO$)>12
 THEN GOTO 580
440 NN=31:PRINT@281," ":PRINT@28
1,"";:LINEINPUTDA$:IFLEN(DA$)<>2
 THEN GOTO 590
450 IFVAL(DA$)<0 OR VAL(DA$)>31
THEN GOTO 600
460 PRINT@284," ":PRINT@284,"";:
LINEINPUTYR$:IFLEN(YR$)<>2 THENG
OTO 610
470 PRINT@288," "
480 AP$="your application is acc
epted"
490 FORT=1TO29:PRINT@447-T,LEFT$
(AP$,T):SOUND230,1:NEXTT
500 IF PR=1THEN 640 ELSE 710
510 '*
520 FORT=1TO3:PRINT@420,"ALL STA
TES USE 2 LETTERS";:SOUND40,8:NE
XTT:PRINT@152," ":PRINT@416," ":
GOSUB200:GOTO260
530 FORT=1TO3:PRINT@416,"ALL ZIP
 CODES HAVE 5 DIGITS.":SOUND70,8
:PRINT@155,"          ":NEXTT:PR
INT@416," ":GOSUB200:GOTO280
540 FORT=1TO3:PRINT@416,"AREA CO
DES HAVE 3 DIGITS.":SOUND70,8:NE
XTT:PRINT@416," ":GOTO310
550 FORT=1TO3:PRINT@416," TELEPH
ONE #'S HAVE 7 DIGITS    WITH A
DASH AFTER THE FIRST 3.":SOUND70
,8:NEXTT:PRINT@416," ":PRINT@448
```

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```
," ":GOTO 350
560 FORT=1TO3:PRINT@417,"THAT'S
NOT YOUR REAL AGE...":SOUND70,8:
NEXTT:PRINT@416,"":GOTO 380
570 GOSUB620:GOTO 420
580 GOSUB630:GOTO420
590 GOSUB620:GOTO440
600 GOSUB630:GOTO440
610 GOSUB620:GOTO460
620 FORT=1TO3:PRINT@422,"USE 2 D
IGITS,PLEASE":SOUND70,8:NEXTT:PR
INT@416," ":RETURN
630 FORT=1TO3:PRINT@417,"ONLY US
E NUMBERS FROM 1 TO";NN:SOUND200
,6:NEXTT:PRINT@416," ":RETURN
640 PRINT#-2,TAB(30)"APPLICATION
 FORM":GOSUB720:GOSUB720
650 PRINT#-2,TAB(5)"NAME:"TAB(20
)L$TAB(40)F$:GOSUB 730
660 PRINT#-2,TAB(20)"LAST"TAB(40
)"FIRST":GOSUB720
670 PRINT#-2,TAB(5)"ADDRESS:"TAB
(20)S$:GOSUB730
680 PRINT#-2,TAB(20)C$", "ST$" "
Z$:GOSUB730:GOSUB720
690 PRINT#-2,TAB(5)"TELEPHONE #:
"TAB(20)"("T$") "TT$:GOSUB730:GO
SUB720
700 PRINT#-2,TAB(5)"AGE:"TAB(12)
AG$TAB(20)"DATE OF BIRTH: "MO$"/
"DA$"/"YR$:GOSUB730
710 END
720 FORT=1 TO 2:PRINT#-2," ":NEX
TT:RETURN
730 PRINT#-2,TAB(20)"------------
-------------------------------"
:RETURN
```

RAINBOWfest Seminar Talks Available On Tape

Copies of all seminars given at RAINBOWfest are now available on audio tape.

In addition, a tape is available of the keynote breakfast speech given by Don Inman. Seminars were given by Fred Scerbo of IMB on educational software; E.R. Bailey of Micrologic on faster Basic; Dr. Hal Snyder of the Northern Illinois Color Computer Club on assembly language techniques; Tom Nelson of Nelson Software on legal aspects of software marketing; Steve Bjork of Datasoft on assembly language graphics; Charles Roslund of Elite Software on machine language utilities and a cooperative session for CoCo clubs with Lonnie Falk of *the Rainbow*. Each session lasted over an hour.

Tapes are $5 each, or all eight for $35. There is a $1.50 shipping and handling charge, whether you buy one or all of them.

Orders should be sent to Seminar Tapes, Prickly-Pear Software, 9234 E. 30th Street, Tucson, AZ 85710. Do not send orders directly to *the Rainbow*, it will just delay your order.

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We hope you waited for this mailing list program, 'cause you'll be mad at yourself if you didn't!! This program has six fields for Name, Address, City and State, Phone number, Zip code, and Code. You can sort alphabetically by last name whether you type your entries with the first name or last name first. You can sort in Zip Code order. You can search your file on any field you like. You can easily add or delete entries. You can print any entry — or all entries — or all entries meeting your search criteria. You can print a phone number list. You can print your labels either one or two across the page. And best of all, you can do all these things with up to 1500 records on a single drive system. Oh yes, all screen display is in full upper and lower case letters on your choice of a green or white background with no adaptors needed. To use this mailing list you need 32K Disk Basic and one disk drive. It comes with very complete instructions and is a truly "User Friendly" program. **$49.95**

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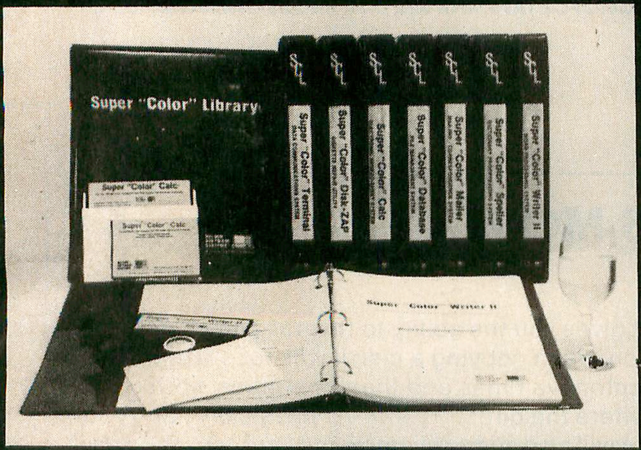

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By Tim Nelson

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By Peter A. Stark

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ELECTRONIC SPREADSHEET By Kevin Herrboldt

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By Tim Nelson

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Version 3.0 By Dan Nelson

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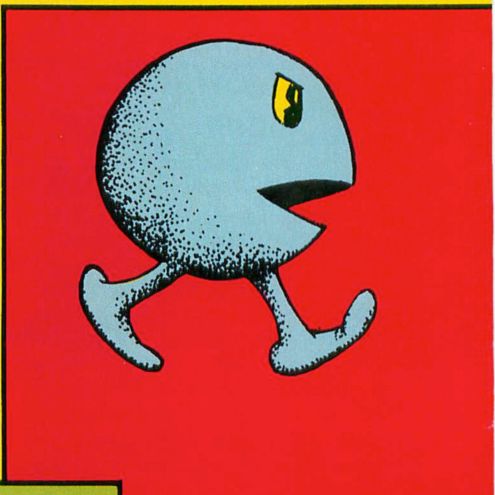
NOW COMES SNAIL'S REVENGE



By Fred B. Scerbo

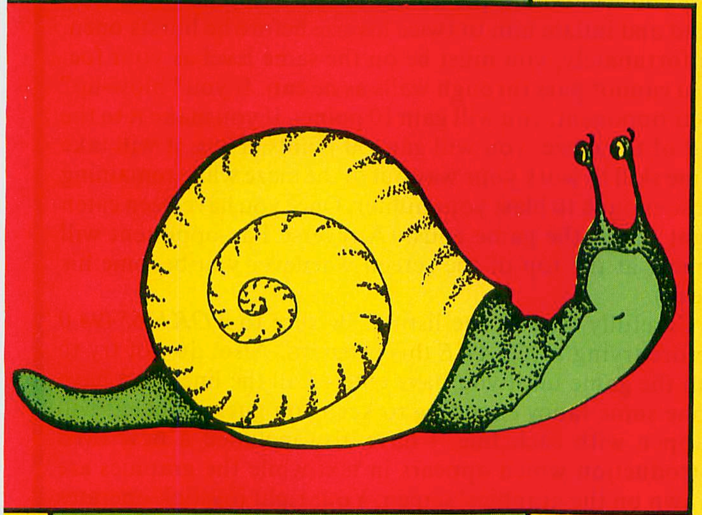
Some of you may recall a program which appeared in *the Rainbow* over a year ago called *Snail Invaders* which was written with the help of Dale 'Snail' Haggerty. Since the publication of that game, many CoCo users have been asking if and when a follow-up to that game would appear. Well, the wait is finally over. With a little graphic help from Dale, we have an even better graphic game now called *Snail's Revenge*.

Dale, a Junior at Drury Senior High School in North Adams, Massachusetts, has not had as much time available to devote to the CoCo this year as he did in the past. Still, we were able to find the time for him to design a new *Snail* graphic and a more impressive title card which appears at the top of the screen. The animation and actual game mechanics are my own. A number of IMB graphic techniques have been further sharpened to milk the maximum speed available from Extended Color BASIC. Originally, this game was written on a 32K machine. However, since a greater number of CoCo owners are still at the 16K level, a little extra time was spent cramming the same graphics into 16K. The result was an even more efficient, structured program.

Now, for a few words about how *Snail's Revenge* works.

Snail is written in PMODE 1:SCREEN1,0. The choice of PMODE 1 over PMODE 3 was for several reasons.

First, there is not too great a difference in the resolution between PMODE 3 and 1. PMODE 3 uses graphic pixels which are rectangular in shape. If we go to PMODE 1, our pixels are twice as wide, and we can obtain a smoother graphic since our pixel settings are not irregular, but perfect squares.



Secondly, PMODE 1 uses half as much memory as PMODE 3. Since this program will use the *PCOPY* command, we need to copy only one page for our animation. The graphics also execute more rapidly since less graphic memory must be relocated by the *PCOPY* command. Of equal advantage is the additional memory this gives us for actual program operation.

The actual execution of this game takes place in only one graphic page which occupies half of the viewing screen. The top half of the screen (page 1) is reserved for the title card and scoring mechanisms. Our game action takes place on page 3 which is *PCOPY* to page 2 which occupies the bottom half of the screen. Since all animation is taking place on page 3 which remains out of view, our movement becomes virtually "flicker-free."

While *Snail Invaders* received its inspiration from other *Invader* style games, *Snail's Revenge* is a distant cousin of the many Pac or Dig games found on the market or in the arcades. The plot is relatively simple, but game play is far from a breeze.

You are The Snail. You are trying to work your way out of a four-level maze.

		54	1867
5	0F0B	69	1A99
17	1102	95	1D89
26	1354	109	1F78
45	15A6	END	218A

The listing:

```
1 PCLEAR3:POKE65495,0:CLEAR190:D
IMW(12),Z(12),U(9),D(9),L(9),R(9
),N(9),AE(12),BE(14),CE(17),V(9)
,O(4)
2 CLS0:R$=CHR$(128):FORS=-16TO80
STEP16:FORI=258TO387STEP32:PRINT
@I-K,STRING$(5,159+S);:NEXT:PRIN
T@418-K,STRING$(5,156+S);:PRINT@
450-K,STRING$(5,128);
3 FORY=0TO6STEP6:PRINT@264+Y-K,C
HR$(145+S)+CHR$(159+S)+CHR$(159+
S)+CHR$(159+S)+CHR$(146+S);
4 FORI=296TO392STEP32:PRINT@I+Y-
K,STRING$(5,159+S);:NEXTI:PRINT@
424+Y-K,STRING$(5,156+S);:PRINT@
456+Y-K,STRING$(5,128);:NEXTY
5 FORY=0TO96STEP96:PRINT@276+Y-K
,STRING$(9,159+S);CHR$(155+S);R$
;:PRINT@308+Y-K,STRING$(10,159+S
);CHR$(152+S);R$;:PRINT@340+Y-K,
STRING$(9,156+S);CHR$(152+S);R$;
:PRINT@372+Y-K,STRING$(11,128);:
NEXTY:K=K+32:NEXTS
6 PMODE1,1:PCLS:COLOR2,3:LINE(0,
160)-(256,192),PSET,BF:LINE(0,16
0)-(256,160),PRESET
7 DRAW"S8BM120,176C3F3DLRDR5E3UH
2L3G2DFR2EHL"
8 DRAW"BM61,176C3G3DRLDL5H3UE2R3
F2DGL2HER":PAINT(20,170),1,3
9 COLOR1,1:GET(120,174)-(144,186
),W,G
10 GET(39,174)-(63,186),Z,G:L$=C
HR$(129):Q$="DPMPS"+L$+"DPNQVUFS
"+L$+"HBNF"+L$+"CZ"
11 FORI=0TO160STEP40:CIRCLE(20+I
,20),12,3,.9
12 PAINT(20+I,20),3,3
13 LINE(8+I,10)-(32+I,30),PRESET
,B
14 PSET(20+I,16,2)
15 NEXTI
16 LINE(32,10)-(22,20),PRESET:LI
NE-(32,30),PRESET:PAINT(24,20),1
,1
17 FORS=1TO22:F=ASC(MID$(Q$,S,1)
)+31:PRINT@324+S,CHR$(F);:NEXTS:
Q$="GSFE"+L$+"TDFSCP"
18 FORS=1TO11:F=ASC(MID$(Q$,S,1)
)+31:PRINT@394+S,CHR$(F);:NEXTS
19 L$=CHR$(209):Q$="TOBJM"+L$+"E
FTJHOFE"+L$+"CZ"+L$+"EBMF"+L$+"I
BHHFSUZ"
20 FORDH=1TO31:ZL=ASC(MID$(Q$,DH
,1)):POKE1472+DH,ZL-65:NEXTDH
21 Q$="BRC1NU4RU4RD4RU4RD4RU4RNL
4D2NL4D2L6C4":FORI=0TO9:READZ$(I
):NEXT
22 DATA BR2U4R3D4NL3,BR4NU4BR,BR
2U2R3U2NL3BD4NL3,BR2R3U2NL2U2NL3
BD4,BR2BU2NU2R3U2D4,BR2R3U2L3U2R
3BD4,BR2U4NR3D2R3D2NL3,BR2BU4R3D
4,BR2U4R3D2NL3D2NL3,BR2BU2NR3U2R
3D4
23 EX$="O1L255BC":I=0:FORII=11TO
227STEP27:I=I+1:V(I)=II:NEXTII
24 I=0:FORII=7TO77STEP22:I=I+1:O
(I)=II+96:NEXTII:I=0
25 LINE(70,32)-(60,22),PRESET:LI
NE-(50,32),PRESET:PAINT(60,24),1
,1
26 LINE(88,30)-(98,20),PRESET:LI
NE-(88,10),PRESET:PAINT(96,20),1
,1
27 LINE(130,8)-(140,18),PRESET:L
INE-(150,8),PRESET
28 PAINT(140,16),1,1
29 COLOR2,3:LINE(26,16)-(22,20),
PSET:LINE-(26,24),PSET
30 LINE(64,26)-(60,22),PSET:LINE
-(56,26),PSET
31 LINE(94,24)-(98,20),PSET:LINE
-(94,16),PSET
32 LINE(144,14)-(140,18),PSET:LI
NE-(136,14),PSET
33 FORI=0TO80STEP40:CIRCLE(20+I,
80),14+LL,2,.9
34 COLOR2,1:LINE(6+I-LL,68-LL)-(
34+I+LL,92+LL),PRESET,B
35 PAINT(20+I,80),2,2
36 CIRCLE(20+I,76-LL),2+LL,2,.9:
LL=LL+2:NEXT
37 FORYP=0TO40STEP40:FORKP=1TO40
+YP:PSET(RND(40)+20+YP,RND(20)+7
0,3):NEXTKP,YP
38 GET(6,68)-(34,92),AE,G
39 GET(44,66)-(78,94),BE,G
40 GET(82,64)-(122,96),CE,G
41 COLOR3,1
42 GET(10,12)-(30,28),R,G
43 GET(50,12)-(70,28),D,G
44 GET(90,12)-(110,28),L,G
45 GET(130,12)-(150,28),U,G
```

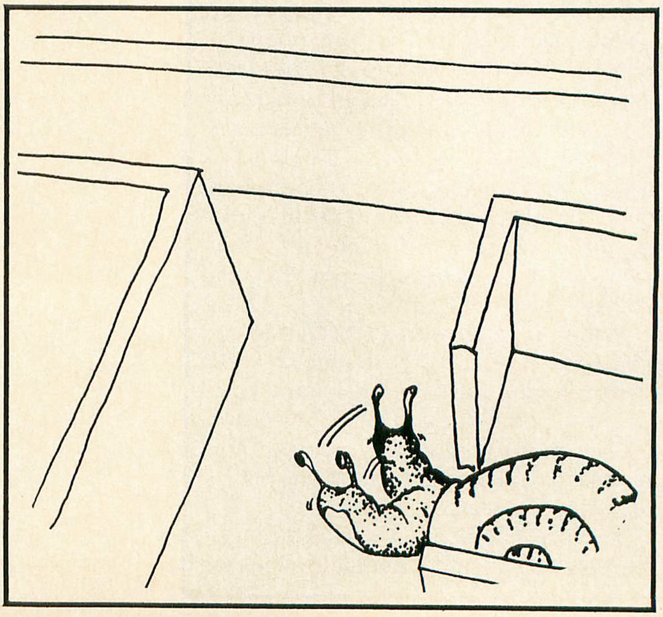
Unfortunately, the corridors of the maze are stalked by a hungry Pac-person with sharp teeth and glassy eyes. You must cautiously work your way through the maze, while your adversary can pass through walls at will. If he attacks you, he will swallow you after rapidly grinding you to snail pulp with his sharp teeth. (Pay particular attention to this gobbling sequence which you do not often find in other games.)

Fortunately, you do have a means of defense. Whenever the small box below the snail at the top of the screen turns red, you will obtain the ability to fire a hose into the Pac-fiend and inflate him to twice his size before he bursts open. Unfortunately, you must be on the same level as your foe. You cannot pass through walls as he can. If you "blow-up" your opponent, you will gain 10 points. If you make it to the end of the maze, you will gain 50 points. Thus, it will take some skill to work your way out of the maze while remaining close enough to blast your hunter. Once you have been eaten eight times, the game ends. (A reverse Pac-opponent will appear at the top of the screen whenever you become his meal.)

Carefully type in the listing. Be sure to *POKE 65494,0* before trying to *CSAVE* this program. Also, do not try to run the game until you have entered all the lines. We have done some fancy encoding to keep you guessing what will happen with each line. I have also included a new IMB introduction which appears in text while the graphics are drawn on the graphics' screen. Your right joystick operates the snail while the fire button controls your shooting.

With a little typing, you will have an arcade game which rivals machine language in speed while using the special features found in Extended BASIC. When trying to reload this program, be sure to *PCLEAR3* or the program will not fit in memory. (Only about 200 bytes remain when running the game.) If your machine cannot handle the *POKE65495,0* then leave it out. The game still has impressive speed without it. This game will work with disk, but you will need 32K.

Enjoy *Snail's Revenge*! While you do, I'll see if I can motivate "Snail" to come up with some ideas for Snail III. (Maybe *Donkey Snail* or *Snail-A-Pede*. Who knows? Only time at the CoCo will tell!



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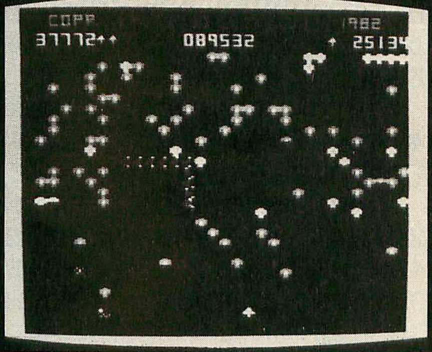

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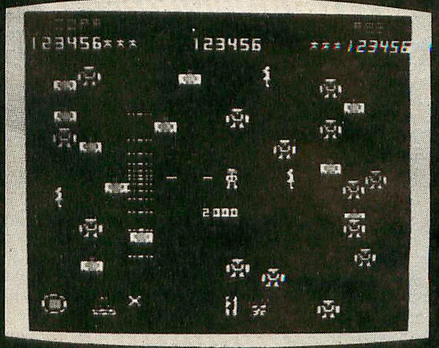

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Requires 32K plus DISK $19.95

MONEY MINDER II is the cassette version of DISK MONEY MINDER. Reviewed in April 1982 Rainbow and improved since then!
Requires 16K but does NOT require Extended Basic $14.95

PIE-CHART is a unique graphing program. It allows you to enter data such as monthly bills, yearly expenditures, etc. This data may be entered as percentages or in its "raw" state. Data entered raw will be converted to percentages by the program. The resulting PIE-CHART can be saved to tape or the data itself can be saved to tape for later use. By using a screen print program (not supplied) you can make printouts of the pie-charts. One unique feature of the program allows you to save a large number of pie-charts or other hi-resolution screens to tape and reload and display them one at a time by "flipping" through them quickly much as you might do with a slide show presentation. This feature would be great for a sales presentation, club meeting or retail display. Other features—automatic screen writing i.e. designations—up to 20 entries possible per pie-chart—keyboard toggle of "raw" vs percentage data entry.
PIE-CHART needs 16K and Extended Basic $10.95

AMORT asks you to input the amount of a loan, the term of the loan and it's interest rate. The program will print to screen and or to your printer and will give you: 1—a running total of principal still to be paid. 2—The amount of the monthly payment applied to principal. 3—The amount of the monthly payment applied to interest. 4—The total monthly payment. 5—The total amount paid into principal to date. 6—The total amount paid into interest to date. 7—The total amount payed out to date.
Requires 16K and Extended Basic $11.95

COLORHYTHM is a biorhythm program for your Color Computer. It plots in High-Resolution graphics (PMODE3) and color a 15 day biorhythm chart displaying your intellectual, Emotional & Physical biorhythms. Reviewed in August 1982 Rainbow.
Requires 16K & Extended Basic $9.95

★ ★ ★ EDUCATIONAL ★ ★ ★

MATCH & SPELL combines a game similar to the familiar TV game of CONCENTRATION and a spelling drill to provide a truely unique and fun program. You may load a spelling list (up to 32 words of up to 11 letters each) from tape or keyboard. The program then allows you to study the list for as long as you like. After that the game begins. One of your words is presented to you either correctly or misspelled with a common spelling error. You are asked if it is spelled right. Then the correctly spelled word is displayed for a brief time and you are then asked to spell the word. The CONCENTRATION type game is played by one or two players during the spelling drill.
A lot of fun for 16K and Extended Basic $11.95

PRESCHOOL PAK consists of two programs for preschooler learning fun. ALPHABET drills the child in alphabet recognition and rewards a correct answer. COUNTER drill the child in counting to 10. Both use Hi-Resolution graphics and sound. Reviewed in September 1982 Rainbow $8.95

MATHWAR is an educational game. In the game the player must jump one space-fighter over another checkers style, until only one fighter remains. Each time a move is selected the program will not complete the move until a math problem is answered correctly. The player selects addition or subtraction and one of four difficulty levels. Level 1 is problems with numbers up to 19 but no carrying or borrowing is required. Level 2 is the same as Level 1 but numbers up to 99 are allowed. Level 3 uses numbers up to 19 but allows carrying and borrowing problems. Level 4 is the same as Level 3 with numbers up to 99. No negative responses to wrong answers and the math score is displayed at the end of the game.
Requires 16K and Extended Basic $11.95

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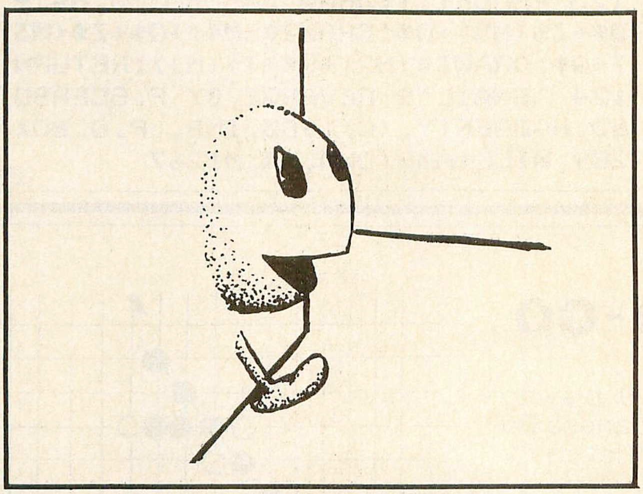
```
46 GET(170,12)-(190,28),N,G
47 PMODE1,1:PCLS:SP=9:LV=4:GOSUB
48:GOTO50
48 I=40:J=40:ZZ=8:OO=6:K=40:M=40
:A=4:B=3:PMODE0,3:PCLS:PMODE1,2:
COLOR2,1:LINE(2,100)-(252,186),P
SET,B:LINE(0,98)-(256,188),PSET,
B:LINE(30,120)-(256,122),PSET,B
49 LINE(0,142)-(226,144),PSET,B:
LINE(30,164)-(256,166),PSET,B:LI
NE(228,98)-(250,100),PRESET,B:RE
TURN
50 PMODE1,1:PCLS:SCREEN0,0:DRAW"
S16BM0,32;C4E4L3E4R3G3R3G5NL3BR2
E5R2F2E2R2G5L2H2G2L2BR10E5R3D5L2
UBUL2ERDBDL3GL2BR10U5R3D5L3BR5U5
R2D3RF2NL5BRBU5RDBD4BR3E2L3E3R3G
2R3G3L3"
51 FORIU=1TO6:READPA:PAINT(PA,26
),4,4:NEXTIU
52 DATA10,50,88,106,130,170
53 DRAW"BM28,66C3L2H3BUU2RD2LBDD
3L2U7R4FD2GF3BRU7R4DL2D2RDLD2R2D
NL4BR4H3U4R2D3FREU3R2D4G3NLBR4U7
R4DL2D2RDLD2R2DNL4BR8L2H3D3L2U7R
2F3U3R2D7BR7L4H2U3E2R3FD2L2UL2D3
FRULURR3DLD2BR2U7R4DL2D2RDLD2R2D
L4"
54 FORFL=1TO7:READ KL:PAINT(KL,4
6),3,3:NEXTFL
55 DATA6,38,58,90,110,142,172
56 PUT(212,16)-(236,28),Z,PSET
57 LINE(208,38)-(236,48),PSET,B:
GOSUB119:GOTO60
58 P=I-2:Q=J:S=K+2:T=M:I=V(A):J=
O(B):K=I+20:M=J+16:COLOR1,1
59 PMODE1,2:PUT(I,J)-(K,M),N,PSE
T:PCOPY3TO2:LINE(I,J)-(K,M),PRES
ET,BF:LINE(V(SP),O(LV))-(V(SP)+2
4,O(LV)+12),PRESET,BF:RETURN
60 PMODE1,1:SCREEN1,0:QR=RND(TIM
ER):RV=RND(10):IFRV>3THEN62
61 LINE(212,42)-(232,44),PRESET,
B:RG=0:GOTO63
62 LINE(212,42)-(232,44),PSET,B:
RG=1
63 PMODE1,2:QR=RND(10):ONQR GOTO
64,67,70,73,67,67,67,73,73,73
64 B=B-1:IFB<1THEN66
65 GOSUB58:PUT(I,J)-(K,M),U,PSET
:GOTO76
66 B=1:E=RND(2):IFE=1THEN67ELSE7
3
67 A=A+1:IFA>9THEN69
68 GOSUB58:PUT(I,J)-(K,M),R,PSET
:GOTO76
69 A=9:E=RND(2):IFE=1THEN64ELSE7
0
```

```
70 B=B+1:IFB>4THEN72
71 GOSUB58:PUT(I,J)-(K,M),D,PSET
:GOTO76
72 B=4:E=RND(2):IFE=1THEN67ELSE7
3
73 A=A-1:IFA<1THEN75
74 GOSUB58:PUT(I,J)-(K,M),L,PSET
:GOTO76
75 A=1:E=RND(2):IFE=1THEN64ELSE7
0
76 PLAY"L255O1CO4CD":IF SP=A AND
 LV=B THEN77ELSE78
77 PMODE1,2:LINE(V(SP),O(LV))-(V
(SP)+24,O(LV)+12),PRESET,BF:PUT(
I,J)-(K,M),N,PSET:GOTO108
78 JH=JOYSTK(0):IFJH>32THEN90
79 SP=SP-1:IFSP<1THENSP=1
80 IFLV=4ANDSP=1THEN83
81 IFLV=2ANDSP=1THEN83
82 GOTO85
```



```
83 JV=JOYSTK(1):IFJV<16THENLV=LV
-1
84 GOTO89
85 IFLV=3ANDSP=1THEN88
86 IFLV=1ANDSP=1THEN88
87 GOTO89
88 JV=JOYSTK(1):IFJV>46THENLV=LV
+1
89 PUT(V(SP),O(LV))-(V(SP)+24,O(
LV)+12),W,PSET:GOTO101
90 SP=SP+1:IFSP>9THENSP=9
91 IFLV=3ANDSP=9THEN95
92 IFLV=1ANDSP=9THEN93ELSE97
93 PMODE1,2:PUT(V(9),O(LV))-(V(9
)+24,O(LV)+12),Z,PSET:PCOPY3TO2:
LINE(V(9),O(LV))-(V(9)+24,O(LV)+
12),PRESET,BF:PMODE1,1:FORPC=1TO
5:M2=M2+1:GOSUB119:SOUND200,1:NE
XT
94 LV=4:SP=9:GOTO97
95 JV=JOYSTK(1):IFJV<16THENLV=LV
```

Genesis Software

presents

Color Computer Programs

★Secret Of The Crypt New!!!

The BIG adventure continues. The sequel to the popular "Enchanted Forest" is here! You'll move in more than 50 hi-res, 3-D graphic scenes searching for clues in an attempt to enter the crypt. But beware, the trail to the crypt is beset with puzzlements. In fact, the crypt's secret will remain a mystery to all but the most adventuresome. Requires 32K extended basic.

Tape cassette (postage paid)..........$21.95

★Bigfoot

Hunt Bigfoot in a hidden maze of caverns and twisting tunnels that are displayed in hi-res graphics as you move. Seek out the lair of Bigfoot while avoiding perils along the way. Features multiple levels and many options of play. Each hunt takes place in a new, randomly generated maze. Challenging and fun. Requires 32K extended basic.

Tape cassette (postage paid)..........$21.95

★The Enchanted Forest

The BIG adventure in hi-res graphics. Move through more than 50 scenes on a quest to rescue the captive princess. Decisions are made according to visual clues, not text. There are many inhabitants in the Enchanted Forest — some are friendly, some are not. This is a sophisticated computer adventure — a real challenge. A must for your adventure library. Requires 32K extended basic.

Tape cassette (postage paid)..........$21.95

(The Enchanted Forest was reviewed in the Dec. 1982 issue of Rainbow).

★The Game Show

Now a lively party game where two teams compete against the clock to name several items in a category. Includes 60 rounds with color graphics and sound. Machine language routine for fast response. Requires 16K extended basic and joysticks.

Tape cassette (postage paid)..........$19.95

(The Game Show was reviewed in the Jan. 1983 issue of Rainbow).

Genesis Software
P.O. Box 936, Manchester, Mo. 63011

Personal checks welcome - no delay.
Missouri residents add 5.625 percent sales tax.

```
-1
96 GOTO100
97 IFLV=2ANDSP=9THEN99
98 GOTO100
99 JV=JOYSTK(1):IFJV>46THENLV=LV
+1
100 PUT(V(SP),O(LV))-(V(SP)+24,O
(LV)+12),Z,PSET
101 IF SP=A AND LV=B THEN108ELSE
PCOPY3TO2:PMODE1,1:SCREEN1,0:PMO
DE1,2:LINE(I,J)-(K,M),PRESET,BF
102 IF PEEK(339)=255THEN60
103 IF RG=0THEN60
104 IF LV<>B THEN60
105 PMODE1,1:LINE(V(SP)+12,O(LV)
+6)-(I+10,J+6),PSET
106 GOTO115
107 GOTO60
108 LINE(V(SP),O(LV))-(V(SP)+24,
O(LV)+12),PRESET,BF:FOREM=1TO5:P
UT(I,J)-(K,M),N,PSET:PLAYEX$:PCO
PY3TO2:PUT(I,J)-(K,M),D,PSET:PLA
YEX$109 PCOPY3TO2:NEXTEM:PMODE1,
1:SCREEN1,1:PMODE1,2:LINE(I,J)-(
K,M),PRESET,BF:LINE(V(SP),O(LV))
-(V(SP)+24,O(LV)+12),PRESET,BF:P
MODE1,1:SCREEN1,1:SCREEN1,0:SP=9
:LV=4
110 MS=MS+1:PUT(MS*24-24,74)-(MS
*24-4,90),R,PRESET:IFMS=>8THEN11
2
111 GOTO60
112 FORI=1TO1000:NEXT
113 X$=INKEY$:IFX$=""THEN113
114 RUN
115 PMODE1,2:PUT(I-4,J-3)-(K+4,M
+5),AE,OR:PCOPY3TO2:PLAYEX$+EX$
116 PUT(I-6,J-5)-(K+8,M+7),BE,OR
:PCOPY3TO2:PLAYEX$+EX$
117 PUT(I-10,J-7)-(K+10,M+9),CE,
OR:PCOPY3TO2:PLAYEX$+EX$
118 M2=M2+1:GOSUB119:GOSUB48:GOT
O60
119 IFM2>9THENM3=M3+1:M2=0
120 IFM3>9THENM4=M4+1:M3=0
121 IFM4>9THENM5=M5+1:M4=0
122 IFM5=>10THENM5=0
123 PMODE1,1:DRAW"C4S8BM188,64"+
Q$+Z$(M5)+Q$:DRAWZ$(M4)+Q$+Z$(M3
)+Q$:DRAWZ$(M2)+Q$+Z$(M1):RETURN
124 'SNAIL'S REVENGE BY F.SCERBO
&D.HAGGERTY,(C)1983,IMB, P.O.BOX
289,WILLIAMSTOWM,MA,01267
```

`NEW´ KODOMO~NO~GO

Get 5 in a row before your opponent. 19 x 19 playing matrix. This is the favorite relaxation game for Japanese Go players. Two-player version and 4 computer skill levels for one player: also Tic-Tac-Toe on the same tape.

$19.95 32K Ext. Basic cassette only.
$14.95 16K Ext. Basic. Three skill levels plus Tic-Tac-Toe.
$ 8.95 16K Ext. Basic Tic-Tac-Toe only.

`ALSO´ CO~EXISTENCE

Successfully develop your country in a resource-limited world. Form a world government, sign treaties, go to war: anything goes. This is a two - to six - player game which combines computer and board play (board and pieces provided).

$24.95 16K Ext. Basic cassette only.

`AND´ 5 EXCITING GAMES

Be a Cosmic Trash Collector, fight a mighty space battle, or surround your opponent in Trap'em — all this and more on one tape. The RAINBOW says, "Great fare for the family with young children."

$15.95 16K Ext. Basic cassette.

RAINBOW
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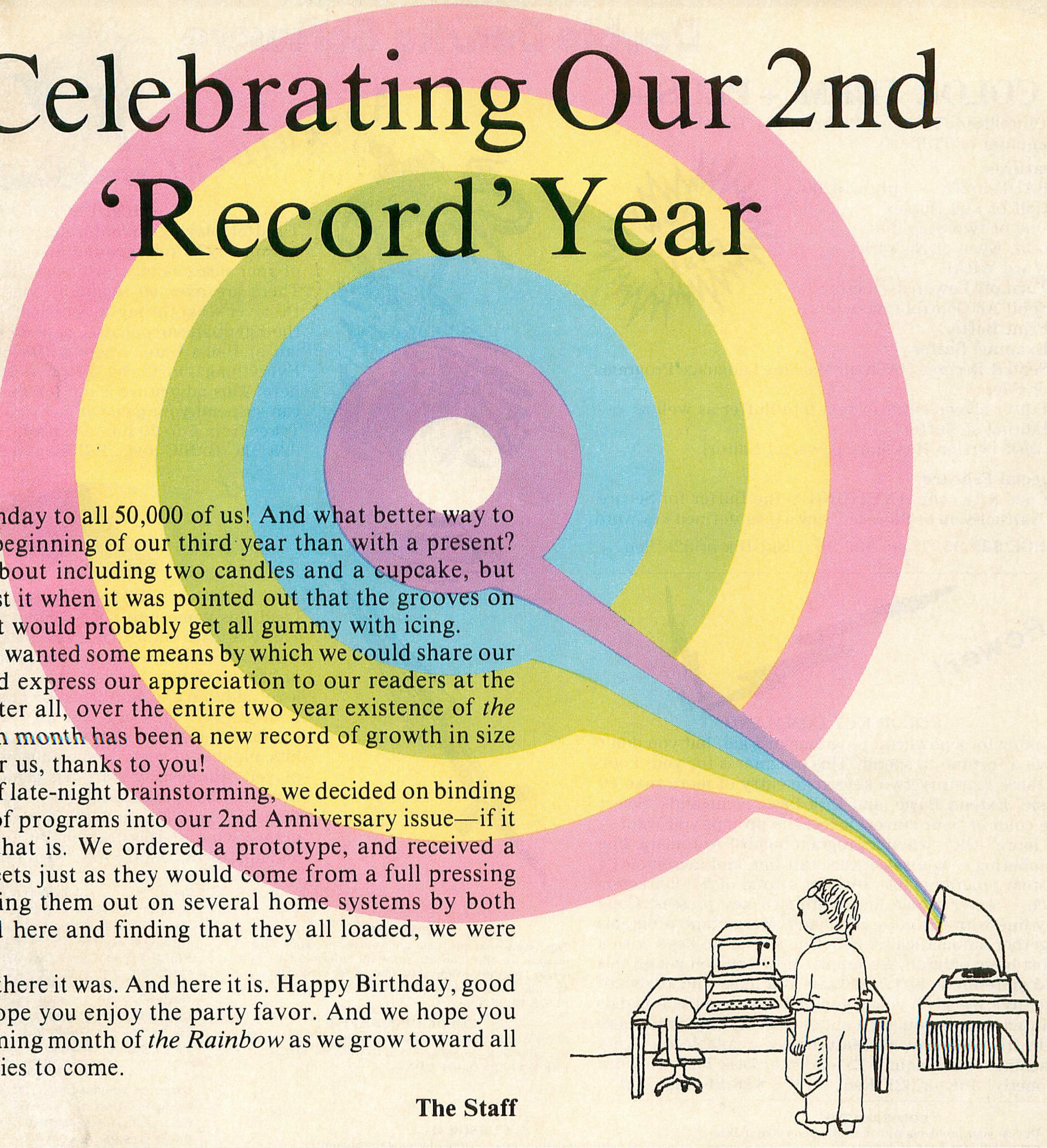
Cherry Hill, NJ 08034

Celebrating Our 2nd 'Record' Year



Happy Birthday to all 50,000 of us! And what better way to celebrate the beginning of our third year than with a present? We thought about including two candles and a cupcake, but decided against it when it was pointed out that the grooves on the soundsheet would probably get all gummy with icing.

Anyway, we wanted some means by which we could share our excitement and express our appreciation to our readers at the same time. After all, over the entire two year existence of *the Rainbow*, each month has been a new record of growth in size and quality for us, thanks to you!

After a bit of late-night brainstorming, we decided on binding a soundsheet of programs into our 2nd Anniversary issue—if it would work, that is. We ordered a prototype, and received a half-dozen sheets just as they would come from a full pressing run. After trying them out on several home systems by both methods listed here and finding that they all loaded, we were satisfied.

Well, then, there it was. And here it is. Happy Birthday, good friends. We hope you enjoy the party favor. And we hope you enjoy each coming month of *the Rainbow* as we grow toward all the anniversaries to come.

The Staff

There are three programs on our soundsheet. Please note that these are not meant as "stand alones," but are meant to be used *after* reading the article and any special instructions in the article on how to load and use the program. For instance, *Memory* (page 202) requires a *PCLEAR 1* prior to loading into 16K machines.

Programs

Shuffle, page 196
Memory, page 202
Home Budget Analysis, page 60.

Instructions for loading record

Important: Carefully remove soundsheet with the aid of a razor blade or other sharp instrument so as not to warp. Also, before loading *Memory*, page 202, be sure to *PCLEAR 1* if you have 16K.

Method 1 — Integrated stereo system with built-in cassette tape deck.

Step 1 — Insert blank tape in the cassette deck and put the record on the turntable. If the record slips on the turntable use a coin as indicated on the record label.

Step 2 — Record all three programs on the record on the blank cassette tape.

Step 3 — Remove the cassette and insert it into your CTR-80 cassette recorder.

Step 4 — Type "CLOAD" on your CoCo and *RUN*.

Method 2 — Stereo system with turntable only.

Step 1 — Make a patch cord to go from your stereo headphone jack to the AUX input on your CTR-80 using a 6' Extension Cord-Miniature Phone Plug (R.S. #42-2420)and a Plug Adapter (R.S. #274-046 or R.S. #274-305). No soldering will be required. (The R.S. #42-2157 Mini Phone Plug to Stereo Phone Plug will also work.)

Step 2 — Record the record on your CTR-80.

Step 3 — Load the tape into your CoCo using "CLOAD" and then *RUN*.

Comments

1) Do not try to input data directly from your stereo system. This could possibly damage your computer.
2) If precise recording levels can be obtained, the recording level should be 10dBM.
3) Once the program is loaded into the computer, save the data to another tape using CSAVE "name of program" for future use.

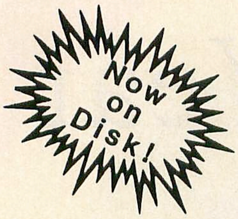
Double Density Software

COLOR TERM +PLUS+

An Intelligent Terminal Program For The Color Computer or TDP 100.

Features:

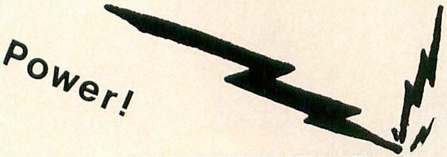
- BAUD RATE — 110 to 19200
- Half or Full Duplex
- One or two Stop Bits
- Odd, Even or No Parity
- Word WRAP
- Turn off Lowercase Letters
- Send All Control Characters
- Print Buffer
- Examine Buffer
- Send & Receive BASIC or Machine Language Programs or Files.
- Editor allows entry of text into Buffer as well as Editing of Buffer.
- (Disk Version Has more powerful Editor)



Special Feature:

Code & Decode **ANYTHING** in the Buffer for Secure Transmission or Storage Using a User defined key word

PRICE **$29.95** (Tape) **$39.95** (Disk) 16k or 32k Req.



COLOR KEY COMMAND

Looking for a powerful programmer's aid, but you don't have a fortune to spend? This program is for you! Look at these features: two keystroke entry of more than 80 Basic, Extend Basic, and Disk Basic commands. Select the color of your cursor. Select the prompt you want — no more "OK" when a program bombs! Automatic line numbering — you select the start line and increment! 4 custom programmable keys for a total of 64 characters each — enter whole lines with two key presses! Copy any line with the copy command. Merge tape programs together automatically. Redefine any or all keys with a short basic program we supply. How can you get all this and more for so little? Because you make the keyboard overlay! We give you a template with all commands printed on it — you cut it out and use it. That is all there is to it! Note: Not all features are available on every machine; some require Extended or Disk Basic to work properly. 16K or 32K Req. PRICE **$18.95** (tape)* **D**

COLOR DOCTOR

Discuss your problems with your computer. **Color Doctor** will discuss your problems with you. This is a great party program! Your friends will not believe that your computer is *talking back to them!* Is it intelligent? It sure seems like it!
16K ext. BASIC Req. PRICE **$15.95** (tape) **D**

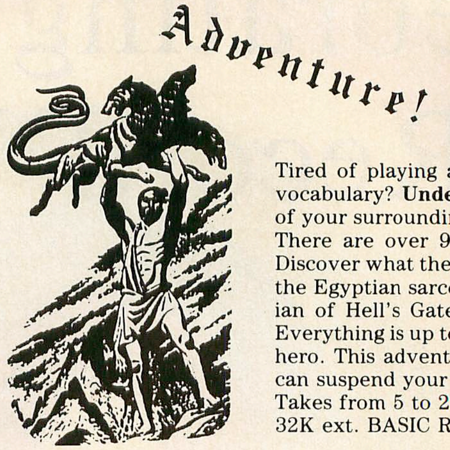
Use your MODEM for something other than a dust catcher—play games!

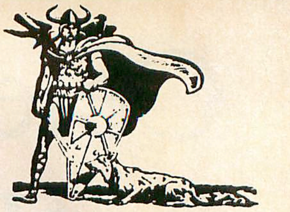
Two tapes and two sets of instructions are included with each MODEM game.

MODEM CHESS Use your **Modem** and your **Color Computer** to play chess *over the phone!* Has high res color graphics board and pieces. Make your move, select a message to send, press a button—seconds later your opponent's board is updated automatically. Has audio alerts, let's you know when a move is being made.
16k or 32k Ext. BASIC Req.
PRICE **$39.95** (tape)** **D**

MODEM CHECKERS Play checkers *over the phone!* Program allows up to 4 jumps to be made at a time, crown pieces, etc. 16k or 32k Ext. BASIC Req.
PRICE **$39.95** (tape)** **D**

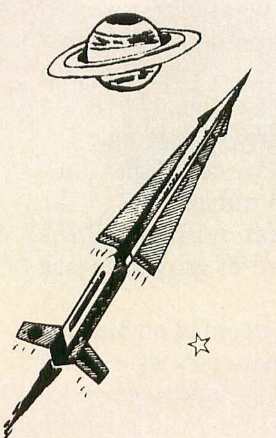
MODEM IAGO Play our version of Othello *over the phone!* Make your move, press a key, your opponent's board is updated seconds later! Has a takeback key if you decide you don't like the move you made. 16k or 32k Ext. BASIC Req.
PRICE **$39.95** (tape)** **D**





UNDERGROUND

Tired of playing adventure games that have a limited vocabulary? **Underground** gives a detailed description of your surroundings, just like a main-frame adventure! There are over 90 separate rooms, passageways, etc. Discover what the mysterious machine does, what lies in the Egyptian sarcophagus, how do you tame the guardian of Hell's Gate, where is the fabled golden apple? Everything is up to you. You give the orders, you are the hero. This adventure is not for the faint of heart! You can suspend your game at any time and continue later. Takes from 5 to 20 hours to play.
32K ext. BASIC Req. PRICE **$26.95** Disk only



GALACTIC MATH

Load this game into your computer and start playing! This is a math tutor that is really an arcade game! Keep those saucers from landing! There are no "happy faces" or "funny clowns" in this math program. This is a multi-level addition and multiplication quiz. You select the difficulty level. This program uses high resolution color graphics and shows the score, elapsed time, number of hits, number of misses and number of "bases" left to the player. Adults may start this game, but the *kids* will finish it! This program has been teacher and kid tested. Realistic explosions and laser fire sounds make this program a winner! This program rates an A+. For grades 1 and up. 16K or 32 Ext BASIC Req. PRICE **$15.95** (tape) **D**

TAPENAME

Tapename searches tape and stores the name of any program or file. You can print the information to the screen, printer or tape. Also checks for load errors.
4k, 16k, or 32k Reg. or Ext. BASIC.
PRICE **$7.95** (tape)* **D**

COLOR DISK SAVER

Saves a disk to tape. Reloads disk from saved tape. Also has tape verify command! 32k Ext. BASIC Req.
PRICE **$12.95** (tape)** **D**

CURSOR II

Hate that blinking cursor? Tired of seeing the computer print "OK" after your program just bombed? **Cursor II** changes the cursor to a solid, non-flashing red. Enter any message up to 200 characters in length. Your message will be displayed instead of "OK".
4k, 16k, or 32k Reg. or Ext. BASIC.
PRICE **$4.95** (tape)*

SUPER PEEKER

This is a BASIC program that will allow the user to explore the inside of the color computer. Explore the possibilities with **Super Peeker.**
16k or 32k Ext. BASIC Req.
PRICE **$9.95** (tape)**

COLOR BIORHYTHM Are you up or down today, tomorrow, or years from now? Find out with COLOR BIORHYTHM. Uses high res graphics. Send the chart to printer. 16k or 32k Ext. BASIC Req.
PRICE **$14.95** (tape) **D**

DD CLOCK Don't forget what time it is when you are programming. The time is displayed in the upper right corner of your screen. Shows hours, minutes and seconds. Beeps every hour.
4k, 16k, or 32k. (Ext. BASIC not required.)
PRICE **$9.95** (tape)* **D**

AUTO LOAD Auto Load will put **any** program or file from tape to disk! All machine language programs that load below the top of your disk system are modified so that they will operate properly with a disk system!
16k or 32k Ext. BASIC Req
PRICE **$12.95** (tape)*

FUN!

CLONE ATTACK

Blast those nasties as they appear! 3 skill levels and 9 levels of difficulty. Uses high res color graphics. Joysticks required. 16k or 32k Ext. BASIC only.
PRICE **$15.95** (tape) (Disk 32k only)

FAST!

MOON BASE INVASION

Nuclear bombs are nearing your cities! Can you stop them before they reach you? High res graphics.
16k or 32k Ext. BASIC Req.
PRICE **$12.95** (tape) **D**

COLOR IAGO

Based on popular Othello game. Match wits with your computer! Uses high res color graphics. 5 levels of difficulty. Joysticks required. 16k or 32 Ext. BASIC.
PRICE **$15.95** (tape) **D**

COLOR COMPUTER/TDP-100

SUPER-PRO

REPLACEMENT KEYBOARD KIT

Save! $64.95

*** All machine code D Disk Compatible**
**** BASIC with machine code subroutines**

Specify Disk when ordering and add $5.00 per program. Save money and ask that all ordered programs be loaded on one disk. You pay only for the one disk! Please add $2.00 shipping and handling on all orders. No extra charge on COD orders, Mastercard and VISA accepted. Allow two weeks for personal checks. Your order will usually be shipped within two or three days. We will notify you of any problems within one week. Send 20 cent stamp for free catalog.

DOUBLE DENSITY SOFTWARE
920 Baldwin Street
Denton, Texas 76201
Phone 817/566-2004.

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THE STEREO COMPOSER

NEW
PRODUCT!

The **STEREO COMPOSER** music synthesizer was developed for the true music lover. All the features available for the **COMPOSER** described below are also available for the **STEREO COMPOSER**. However, instead of using the single 6 bit digital to analog converter built into the computer and the speaker built into your TV, the **STEREO COMPOSER** uses two 8 bit digital to analog converters which drive two audio power amplifiers. These amplifiers supply enough audio power to easily drive your own external speakers. If you like, the output may be connected to your home stereo system to further increase fidelity. Connection is provided by two phono connectors. If the music is too loud, two built-in volume controls are provided to allow you to control the volume of each of the channels separately. The advantage of being able to use external high quality speakers is obvious. The use of higher quality digital to analog converters serves to further increase music fidelity.

The **STEREO COMPOSER** produces music in stereo. Of the 4 voices produced, 2 are directed to each channel. This ability alone increases the realism of the music. You can even move the voices between speakers as the music plays.

The **STEREO COMPOSER** comes assembled, tested, burned in, with all the software and hardware to allow you to immediately start enjoying your music. A complete manual and examples are provided to give you everything you need to know.

The **STEREO COMPOSER** is completely memory decoded so it does not conflict with the Radio Shack disk controller. In this way, disk owners with an expansion interface such as the BT-1000 by Basic Technology can produce music from disk with the **STEREO COMPOSER** in one slot and the disk controller in another. In fact, you can even have **THE VOICE** in another slot without any fears that there will be memory conflicts.

Requires Extended BASIC and Minimum of 16K
Specify Cassette or Disk

STEREO COMPOSER (Hardware and Software) $119.95

THE COMPOSER

The **COMPOSER** is a 4 voice music compiler which easily allows one to develop high quality music. Each voice is programmed separately. In addition, each voice uses its own waveshape table which means a unique sound for each of the 4 voices.

The **COMPOSER** features a 7 octave range. It supports dotted and double dotted notes as well as eighth, quarter, and standard triplet notes. Sixteenth and thirty second notes are also supported.

The **COMPOSER** allows the music to be played at any tempo and in any key. And believe it or not, the tempo and key can be modified as the music plays. This gives the user tremendous versatility in developing music. Key modification also allows the user to move the music up or down one or more octaves.

The **COMPOSER** displays a constantly changing random kaleidoscope pattern as the music plays. In addition, the number of the note being played is displayed which aids one in finding sour notes during music development. Both of these displays can be disabled to allow any screen to be displayed while the music is playing. In this way, one can show the words to a song or display a picture as the music plays.

The **COMPOSER** develops a machine language position independent subroutine that can be Saved, Loaded, and Executed independent of all other software. This means that you can share your music with friends. In fact, you can write your own BASIC programs that call and play the music. Software vendors may include the music in their own product.

The **COMPOSER** is menu driven making it extremely easy and friendly to use and operate. A thick operating manual is also provided. Many examples are given to aid the user in getting started. All you need is provided, no additional hardware is necessary. Don't let the price fool you, the **COMPOSER** has got to be heard to be appreciated.

Requires Extended BASIC and Minimum of 16K

CASSETTE VERSION $24.95
DISK VERSION (32K) $29.95

THE VOICE

NEW
PRODUCT!

SPEECH SYSTEMS got its start providing high quality speech synthesizers for SS-50 bus computers. We are now proud to announce the same high quality product for the Color Computer and TDP-100.

THE VOICE should not be mistaken with software speech synthesizers which require the computer to do all the work in producing speech.

THE VOICE uses a special large scale integrated circuit, the SC-01 by VOTRAX, to reproduce any one of 64 phonemes at 4 inflections. Phonemes are basic units of speech which allow one to reproduce any word in English as well as many other languages.

THE VOICE has two outputs. Speech may be heard through the user's TV speaker, or the built-in audio power amplifier may be connected to your own external speaker. A phono connector is provided for this purpose and if the volume is too high, a built-in volume control may be used to adjust it to the proper level.

THE VOICE comes assembled, tested, burned in, with all the necessary hardware and software. A complete manual with many examples are provided to get you started in developing your own BASIC or machine language programs to use speech.

THE VOICE is completely memory decoded so it does not conflict with the Radio Shack disk controller. In this way, disk owners with an expansion interface such as the BT-1000 by Basic Technology can produce speech from disk with **THE VOICE** in one slot and the disk controller in another. In fact, you can even have the **STEREO COMPOSER** in another slot without any fears that there will be memory conflicts.

We are trying to develop a library of software for **THE VOICE**. Toward this end, we will be offering substantial royalties to software authors for their work.

Requires Extended BASIC and Minimum of 16K
Specify Cassette or Disk

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Learning Through Program Dissection

By Joseph Kolar
Rainbow Contributing Editor

You've come a long way! It is time to introduce you to program analysis.

There comes a time, which you may have reached, when things begin to fall into place. You know the rudiments of BASIC and have spent a lot of time at the keyboard. You are beginning to get the feel of computing. It is all starting to make sense. But, not quite!

There are some things that remain hazy. Things you don't grasp. You understand the program "in toto," but not every line. In fact, a few lines may not ring a bell at all.

Dredge up the *3CRAPS* program listing from our June installment. It will be used as the example to demonstrate one way to analyze a program. This will be a learning experience, and in a sense you will become an author.

A notebook, similar to the reference notebooks you created, will be used. Do not number the pages. Using a black, felt-tipped pen, on a well-centered, gummed label, print "program analysis." On the inside cover, about two inches from the top, draw about five horizontal lines. Print "contents" neatly, above the top line. Between the two top lines you drew, print neatly, "3CRAPS," or some title that is meaningful to you.

On the top line of the first page, print in red ink, "analysis of 3CRAPS." Skip a line. In black ink, print in paragraph form, a summary of the program. Use your own words and add anything you discover as you analyze the program.

An example: "This is an attempt to analyze, by dissecting line by line, a home-made 3 crap dice game taken from *the Rainbow*, June 1983."

Remember, when you analyze a program, no permanent modifications, revisions or improvements are made. This is a no-no!

CLOAD and *RUN* the program. Look it over carefully and compare it with your listing. Then, *LIST* it in increments, (list-100; list 100-200) and try to figure out the purpose of each line. Keep your program in memory. You may want to run the program or just a part of it to verify how a line reads and what it does.

Note: You can run a program from a selected point by "*RUN* 130-" to begin at line 130. Try it and see what happens. *RUN* 140- to *RUN* 170-. Notice the different results you get. Some lines may give a UL error. Try to figure out why.

Good starting or insertion points are at *CLS, PRINT* or *REM* lines. They will carry the program forward to a logical stop, *INPUT* or press *ENTER*, awaiting some information necessary to continue. If none is demanded, the program will run to the end. These are good entry points to check out certain parts of a program.

Suppose you wanted to check out line 220 in action. Line 220 states that if the total of the three dice is four you will *GOTO* line 570, which, after a short pause, will tell you on a blue background the bad news that you lost. You might have to wait all day for a four to be cast. One way to overcome this would be to inject the desired result, "4," by changing lines: 140 B=1; 150 A=1; 160 C=2. Another way: change line 170 R=4 which ignores the results of lines 140-160. There are other ways to achieve the desired result. Can you work out

---

(Joseph Kolar is a free-lance writer and programmer dedicated to proselytizing for computers in general, and the CoCo specifically.)

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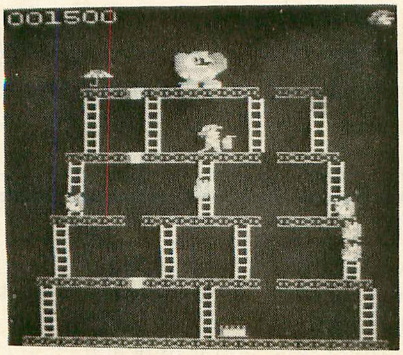

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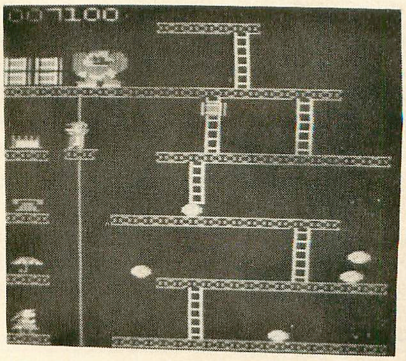

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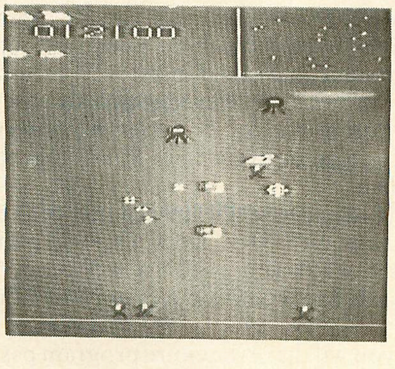

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any? Of course, you must restore the original line or you will be "4'ed" to death.

If you have Extended Color BASIC, you can *TRON* your way through a program. We shall assume that you have Color BASIC only.

By now, you are hopelessly addicted to the 80C. If you have 4K, Color BASIC, I strongly urge you to have your machine upgraded to include Extended Color BASIC and 16K, in that order. You are going to do it anyway. You will be glad you did!

Back to the drawing board. After your introductory notes, skip a line. In black ink, print "10" to the left of the red, vertical line. To the right of this line, print in black ink the actual listing of line 10, up to the color (:), which separates multiple statements massed in one line. On the next line, indent about an inch and in red ink, using your own words, print an explanation of the meaning of that segment of the line: "blank out the screen." In black ink, on the next line, lined up with the black listing, print ":PRINT." Indent an inch on the next line and in red, print "skip a line."

Next line: write 20 to the left of the red, vertical line. Print the following: print "rules" to the right. Count the spaces between ("") and (R) and write the number, enclosed in a circle in the space. (Sometimes, it is easier to count them from the screen than the line listing.) On the next line, indent and in red, print: the word "rules" is centered on the screen. Do you know another way to achieve the same result? If you do, in pencil write any alternate way you have discovered to get *exactly* the same result. Try it out to be certain by replacing line 20 in the listing and *RUN* it. Restore the original line.

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Follow the same format throughout, systematically progressing from one line number to the next. Do not skip a line number. If you are uncertain of the meaning of a line, leave adequate space to put in your explanation at a later time. List multiple entries, separated by a (:) separately. The exception would be an obvious case such as *line 30 PRINT: PRINT:PRINT.* Put the entry on one line in black; indent on next line and in red print "skip three lines."

> *"There comes a time, which you may have reached, when things begin to fall into place. You know the rudiments of BASIC and have spent a lot of time at the keyboard. You are beginning to get the feel of computing. It is all starting to make sense. But, not quite!"*

Drop down to line 180. It would be listed, in its turn, as described above. An explanation could be "print the results of the cast of the 'A' die at screen location 200. Verify the location by checking the print @ worksheet in the manual." If you know another way, add it in pencil. You could say: "PRINT @ 32*6+8,A."

Drop to line 480, which would be listed in its proper turn. This line means that if you rolled a number, 2, that was not equal to the number you were supposed to roll, R, or was not a 10, then get set to make another cast. Notice how lines 480-500 give you all possible directions for any number that might be cast.

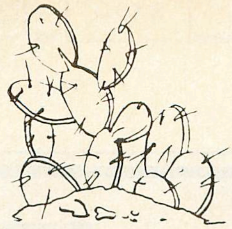
Isn't it interesting to puzzle out the significance of every line? But, what happens when you get hung up? If you can't figure it out, try different strategms. For instance, *RUN* the program from some entry point near the problem area. Delete the line or lines that bug you. See what happens. (Remember to replace the lines later.) Pass around the problem line with a *GOTO* or insert an (') at the beginning of a line to effectively bypass the line. Substitute other data. Introduce temporary markers. (Insert an * at some point.) There are lots of things you can try to isolate the problem. *RUN* the program or part of the program, observing what changes occur, and you will get many good clues to help you solve the problem.

Finally, if all fails, leave a few lines blank for the explanation. Continue, and return to it later. This will indicate your weak areas and what you need to work on. Don't be obsessed with it. It may come to you later like a flash out of the blue.

Eventually, you will have the entire program psyched out. Good for you! Getting it down on paper helps to jog your memory.

At some time, you will come across an intriguing and more complex program listing that you will want to dissect and study. Save it for a project and when you want a change of pace, get the old notebook out and chop it up.

After you do four to six analyses, you will discover that you will begin to meaningfully read listings and give up dissecting programs. That is as it should be. In the meantime, have fun!



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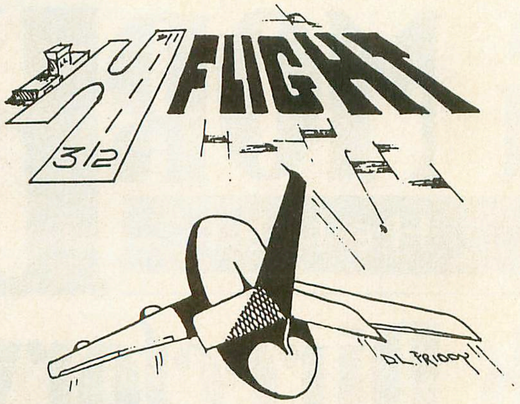

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GETTING MORE From the Disk Directory

By Melvin Hefter

Most people with disk systems use the *DIR*ectory command to list the names of files on their diskette, but many may not have a good idea of what the disk directory really is and other ways it may be used. The disk directory is that information stored on the diskette which tells Disk BASIC what files are there and *where those files are located*. Disk BASIC needs this information to use these files to store programs or data.

The total disk directory is composed of a file allocation table and directory entries for each file. When you use the *DIR* command, this information is combined to tell you the name and size of each file. You can redirect this information to your printer by *POKE*ing the printer's device number (254) into location 111 before requesting the directory listing. *POKE* 111,254:*DIR1* will print the directory for drive 1.

Disk BASIC divides the diskette into 35 tracks. You can visualize these tracks as concentric circles. Each track is sub-divided into 18 sectors. The designation of a track and sector identifies a unique area of the disk which contains 256 bytes of information. The Disk BASIC file system groups nine of these numerically adjacent sectors into a unit called a *Granule*. There are two Granules per track. A Granule is the smallest unit that will be allocated to a file. The use of this Granule convention results in fewer disk areas for the file system to manage. There is no reason that this value had to be nine. Tandy could have decided to group six, or three, or two sectors into an allocation unit, or even allocated individual sectors. The use of a smaller allocation unit would haver resulted in less disk data area being wasted, but more disk space being required for directory information and more overhead in the allocation process. The file system uses track 17 for the directory information. This leaves 34 tracks (68 Granules) available for files. The table below shows the track/sector of the first sector of each Granule.

Granule #	0	1	2	3	4	5	6	7	8	9
0	0/1	0/10	1/1	1/10	2/1	2/10	3/1	3/10	4/1	4/10
10	5/1	5/10	6/1	6/10	7/1	7/10	8/1	8/10	9/1	9/10
20	10/1	10/10	11/1	11/10	12/1	12/10	13/1	13/10	14/1	14/10
30	15/1	15/10	16/1	16/10	18/1	18/10	19/1	19/10	20/1	20/10
40	21/1	21/10	22/1	22/10	23/1	23/10	24/1	24/10	25/1	25/10
50	26/1	26/10	27/1	27/10	28/1	28/10	29/1	29/10	30/1	30/10
60	31/1	31/10	32/1	32/10	33/1	33/10	34/1	34/10		

Tabulation Of Track/Sector For Each Granule

The file allocation table (which is really a Granule allocation table) is located in sector 2 of track 17. Only the first 68 bytes of this sector are used. Each byte corresponds to one Granule on the disk. The first byte will give the status of Granule 0. The 15th byte will be the status of Granule 14. If the value of the byte is 255, it means that the corresponding Granule is not in use. A byte value between 0 and 67 indicates that the corresponding Granule is in use, *and the* byte value is a pointer to the next Granule of the file. This means that this Granule is *not* the last Granule of the file. A value between 192 and 202 means that the corresponding Granule is the last Granule of the file and tells how many of the 9 sectors in that Granule are part of the file. The file allocation table does not provide enough information to tell where any given file begins.

Sectors 3 through 11 of track 17 contain the actual names of the files on the disk and other information including the number of the first Granule of each file. This information is referred to as the directory entry. The directory entry for

---

(Mr. Hefter is president of Custom Software Engineering of Cocoa Beach, Florida)

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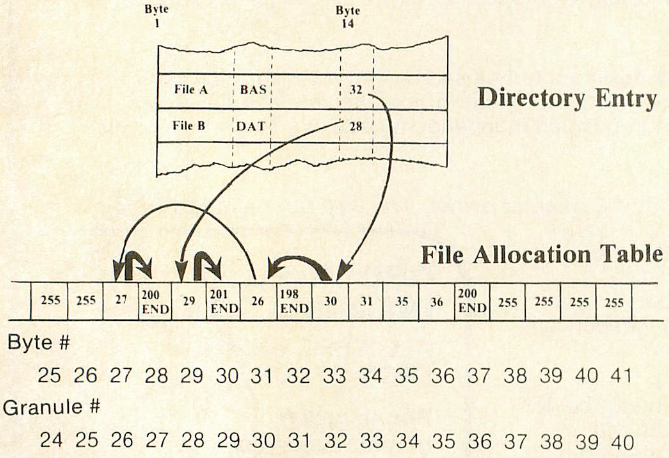
each file does not tell how many Granules long that file is. This is why both the directory entry and the file allocation table are required to produce the *DIR* listing. The directory entry tells where the file begins. Counting the Granules as it traces through the file allocation table until it finds the last Granule tells how long it is. Figure 1 illustrates how this all works.

Each directory entry uses 32 bytes even though only 16 bytes contain any useful information. The first 8 bytes are the file name and the next 3 are the extension (BAS, DAT, etc.). If the first byte of the file name is zero, it means that the file has been killed. If the first byte of the name is a 255, it means that entry and all following entries have not been used—no need to look further. It is the 14th byte of each entry which tells the number of the first Granule of that file.

The disk directory is not part of any file and may not be *OPEN*ed or read with the *INPUT* command. Disk BASIC provides another command which will bypass the file system and allow you to directly read *any* sector of the disk. This is the *DSKI$* command and uses as parameters the drive number, track, sector, and two string variables—one to receive the first 128 bytes of the sector and one for the last 128 bytes. (Remember that one string variable will not hold more than 255 bytes).

Now we have enough background to put that disk directory to work for us. Listing 1 shows a program which may be used to get a different kind of directory listing. This program will produce a map which shows which Granules are used for each file and their order of use. This program checks the first character of the file name for 255 (line 50) to find the first unused entry (no need to read further) and checks for a zero (line 70) to see which files should be omitted from the listing. Line 80 prints the file name and extension and finds the first Granule of the file. Line 90 traces through the file allocation table until the last Granule is found. This program is written to allow you to customize it for your own use. For example, if you want the listing in alphabetical order, just add a bubble sort between line 60 and 70. Or if you want only BASIC programs listed, test for this in line 70. Try running this program on several of your diskettes.

Figure 1



The map produced may be of use if you have problems with your diskette. Listing 2 is a short program which may be used to read all sectors on a diskette. If you get an I/O error while trying to backup a diskette, run this short program. It will terminate with an I/O error, but the last track/sector displayed on your screen will tell you the first sector which cannot be read. You can generally make this sector readable by writing over it with a DISKO$ command. You can then use your map and the track/sector vs. Granule table to see which file (if any) has lost data. Remember to run the program (listing 2) again to confirm that the sector is readable and see if any other sectors are bad.

The directory map is also of use to show you how your diskette is organized. If you have a map of a diskette you just put into service, it will probably show the files are well organized. Files are clustered around the middle of the diskette and multi-Granule files are using adjacent areas. But a map of a diskette which has been used for a while and which has had files grow or shrink in size, files deleted (killed), and others added, shows a less organized picture. The disk system will try to allocate adjacent Granules when it can. This is more than just aesthetically pleasing. It also allows files to be read or written with a minimum of time required to reposition the read head. But if you have several files (data or program) which gradually grow over time, the allocation pattern is one of intertwined Granule allocation.

The disk system *BACKUP* capability is good for making an exact duplicate of your diskette. It makes a physical copy—that is, it copies all sectors whether used or not. The *BACKUP* process does nothing to reorganize your disk and get things back to a neat (and efficient) allocation. The disk system *COPY* command does write a file copy as if it is just being created, and in so doing keeps things together. You can create a new and well organized disk just by copying all of your old files to that new disk one by one. If you have many files on the disk, this will be a bit of a chore.

But unlike the *BACKUP* command, the *COPY* command can be used by a program. The disk manual states that the *COPY* will erase memory, but it really doesn't. What it does do is use whatever memory is not in use by your program. The more memory available, the better *COPY* will work on longer files.

Listing 3 is a program which will copy all files on a diskette in Drive 0 to Drive 1. The effect of copying all files is to produce a logical backup of your diskette. But since this new diskette will probably be better organized (more efficient) than the original, you may want to make it your new working copy and keep the original as the backup. The *COPY* command will not write over an existing file. To use this program, the new diskette must not have any files with the same name as those on the diskette to be copied. This will generally mean a newly formatted diskette.

The use of this program also has some other advantages. The program will not try to read unused sectors so an unreadable but unused sector will not be a problem. If your old diskette is only partially filled, this procedure may actually be faster than the *BACKUP* command. You may use this program to make one backup diskette combining two half-filled diskettes as long as file names do not repeat. And you may add those customizing touches like sorting the file names or copying only program files or only files which start or end with this or that. If you found a disorganized diskette with program Listing 1, try program Listing 3 on it and then get a map of the new diskette to see what neat means!

Unfortunately, Listing 3 will not work on a one-drive system. Program Listing 4 shows the modifications required for a logical backup using only one drive. This version does have many of the advantages of Listing 3, but it also has one major disadvantage. You will need to switch diskettes at least once for each file to be copied. For a single drive system, the *BACKUP* command will generally be easier and

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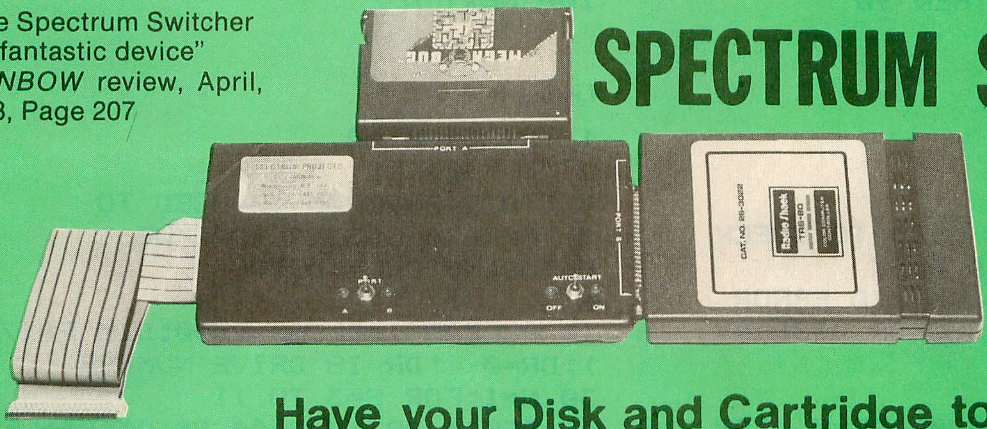
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all orders plus $3 S/H, N.Y. residents add sales tax faster than Listing 4 (unless you only have about half a dozen files). But you may wish to use the program when the map shows a real need for reorganization.

You will probably find these small utilities useful. But more important, the use and understanding of these programs will give you a better idea of how the file system uses the disk directory and how to make it work for you.

Listing 1:

```
1 'LISTING #1
2 '
3 'THIS PROGRAM IS USED TO
4 'PRODUCE FILE ALLOCATION MAP
5 '
10 PCLEAR 1:CLEAR 2000:DIM F$(72
):DR=0  'DR IS DRIVE NUMBER
20 DSKI$ DR,17,2,AL$,B$
30 N=1:FOR S=3 TO 11
40 DSKI$ DR,17,S,A$,B$:A$=A$+LEF
T$(B$,127):FOR J=0 TO 7
50 F$(N)=MID$(A$,J*32+1,16):IF L
EFT$(F$(N),1)=CHR$(255) THEN N=N
-1:GOTO 61
60 N=N+1:NEXT J,S
61 'BUBBLE SORT CAN GO HERE
70 FOR M=1 TO N:IF LEFT$(F$(M),1
)=CHR$(0) THEN 100
80 PRINT#-2:PRINT#-2,LEFT$(F$(M)
,11);"   ";:G=ASC(MID$(F$(M),14,1
))
90 PRINT#-2,G;"-";:G=ASC(MID$(AL
$,G+1,1)):IF G<68 THEN 90
100 NEXT M
```

Listing 2:

```
1 'LISTING #2
2 '
3 'THIS PROGRAM IS USED TO CHECK
4 'ALL SECTORS ON A DISK
5 'IF IT ENDS WITH AN I/O ERROR
6 'THE LAST TRACK/SECTOR DISPLAY
7 'IS NOT READABLE
8 '
10 PCLEAR 1:CLEAR 8000:DR=0  'DR
 IS DRIVE NUMBER
20 FOR T= 0 TO 34:CLS:FOR S=1 TO
 18
30 PRINT T,S:DSKI$ DR,T,S,A$,B$:
NEXT S,T:CLEAR 2000
```

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Listing 3:

```
1 'LISTING #3
2 '
3 'THIS PROGRAM IS USED TO
4 'MAKE A LOGICAL BACKUP FROM
5 'DRIVE 0 TO DRIVE 1
6 '
10 PCLEAR 1:CLEAR 2000:DIM F$(72
):DR=0  'DR IS DRIVE NUMBER
30 N=1:FOR S=3 TO 11
40 DSKI$ DR,17,S,A$,B$:A$=A$+LEF
T$(B$,127):FOR J=0 TO 7
50 F$(N)=MID$(A$,J*32+1,16):IF L
EFT$(F$(N),1)=CHR$(255) THEN N=N
-1:GOTO 61
60 N=N+1:NEXT J,S
61 'BUBBLE SORT CAN GO HERE
70 FOR M=1 TO N:IF LEFT$(F$(M),1
)=CHR$(0) THEN 100
80 W$=LEFT$(F$(M),8)+"/"+MID$(F$
(M),9,3):PRINT W$:COPY W$ TO W$+
":1"
100 NEXT M
```

Listing 4:

```
1 'LISTING #4
2 '
3 'THIS PROGRAM IS USED TO
4 'MAKE A LOGICAL BACKUP
5 'USING ONLY DRIVE 0
6 '
10 PCLEAR 1:CLEAR 2000:DIM F$(72
):DR=0  'DR IS DRIVE NUMBER
30 N=1:FOR S=3 TO 11
40 DSKI$ DR,17,S,A$,B$:A$=A$+LEF
T$(B$,127):FOR J=0 TO 7
50 F$(N)=MID$(A$,J*32+1,16):IF L
EFT$(F$(N),1)=CHR$(255) THEN N=N
-1:GOTO 61
60 N=N+1:NEXT J,S
61 'BUBBLE SORT CAN GO HERE
70 FOR M=1 TO N:IF LEFT$(F$(M),1
)=CHR$(0) THEN 100
80 W$=LEFT$(F$(M),8)+"/"+MID$(F$
(M),9,3):PRINT W$:COPY W$
90 IF M<N THEN PRINT:PRINT"INSER
T SOURCE DISKETTE AND":INPUT"PRE
SS ENTER";C$
100 NEXT M
```

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Consider that just a year ago the cupboard was woefully bare and comparable power cost almost three times as much, and your basic unit was a 4K machine.

Consider that when you finished your journey through the accompanying manuals and went out shopping in search of software, almost all you could find were a few game cartridges. Foggy memories? Then pull out some of your back issues of *the Rainbow* and check out the advertising. Now compare that with today's level of third party software and hardware advertising for our Color Computer. Notice anything significant? Sure the quantity has increased almost immeasurably, but look at the quality and diversity!

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Take for example this brand new product that came across my desk for review just recently. *GRAFPLOT* is its name, a general graphing program. Written in open BASIC, it's described as being capable of turning your Color Computer "into a sophisticated data plotter, producing professional quality graphs of any type of X-Y data" and promises that you'll never have to mess around with pencil, graph paper and ruler again. And I thought it was another program designed to print text on the graphics page before I cracked the manual!

GRAFPLOT is an applications program which will find itself equally useful in the home and office Color Computer—although probably more so in the latter case. And that, although not revolutionary, is progress, my friend!

So what's so great about this product? After all, you can learn how to make graphs from the computer manuals. But I guarantee you won't be able to do it nearly as well and with the diversity that *GRAFPLOT* offers. I know there's a new product out from the Fort Worth folks, but it's ROMpak based, isn't it? I find those cartridge programs so limiting for some reason.

GRAFPLOT comes in two versions: a cassette version for 16K machines; and a disk version for 32K machines. For the cassette version, you'll need a minimum of 16K with Extended Color BASIC and, naturally, a good cassette recorder. For the disk version you need 32K Disk Extended Color BASIC with one or more drives. Optional equipment requirements to get hardcopy printouts of your graphs are listed as a Line Printer VII or DMP-100 and the Radio Shack screenprint program. (There is a section in the manual on how to interface other screenprint routines and printers with *GRAFPLOT.*)

Well, I found and blew the dust off my long unused copy of the screenprint program with a sigh of relief. But since changing over to the faster, smarter and much neater Okidata 82A, I had passed my LP VII along to my computer engineering daughter. All I could do was cross my toes in hopes of discovering that the Oki' would work out. (It went crazy when I tried to get a screen print!)

After carefully reading through the documentation's 34 pages, it was time to tackle the program. Unfortunately, I couldn't think of anything I wanted to plot out on a graph at the time! Wouldn't you know it? Well, anyway, the manual includes an extensive tutorial section with a set of basic data provided to permit you to initiate a number of graphs and even includes printouts of what they should look like. Why not use these data, I said to myself.

Following the manual's instructions to clear the machine for all available memory (aimed at the 16K user), I loaded in the first cassette program and started following the step by step tutorial. Once I had entered the data and checked it, I simply called for the graph to be drawn on the high resolution screen. I was both surprised and pleased at the results. Looking good, CoCo! The screen presentation, using PMODE 4, was clear and very crisp indeed. Even though the steps taken to get that display were at first kind of confusing, I quickly got used to it, thanks to the meticulous "handholding" documentation.

After discovering that the Okidata 82A wouldn't respond to the screenprint program (I should have known better), I "borrowed" and hooked up the LP VII and soon produced my first hardcopy printout. The image produced by the LP VII left much to be desired in my opinion: too small (3"h x 4¼"w) and kind of jagged. Maybe the latter is a result of a

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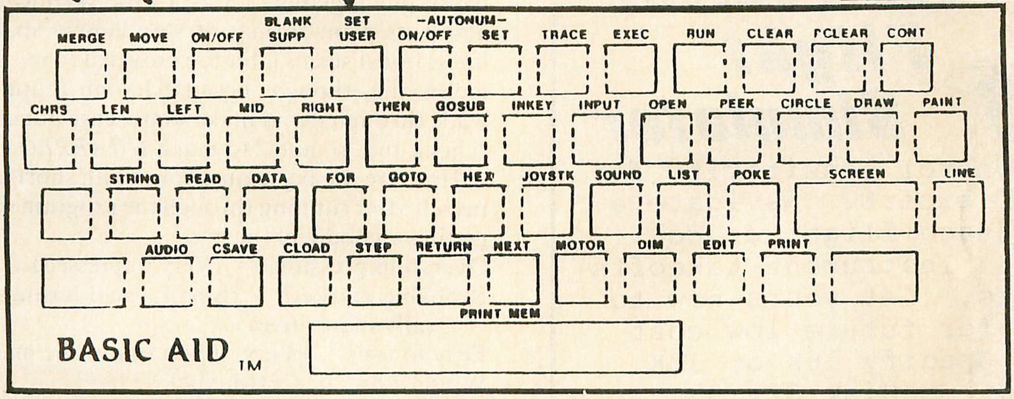
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BLANK SUPP
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-AUTONUM- ON/OFF
SET
TRACE
EXEC
RUN
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CONT
CHR$
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MID
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much-used printer head, though. I found the first prints coming out in white on black. Remembering that I could *POKE* value 255 into memory location 16303, I soon changed that to a black on white printout. (The disk version takes care of this for you by modifying the screenprint program and relocating it to high memory.

One last word about the cassette version and we'll move on. Because *GRAFPLOT* itself consists of two programs, you'll find yourself shuffling back and forth among three cassettes: the program tape, screenprint, and a data tape. You might get a bit confused at first, but it'll wear off soon, especially if you keep your work area clean and neatly organized.

The disk version is much easier to use. After the long process of backing up the master disk's two programs and then bringing the main program up, you're asked if you have a copy of the modified screenprint program on the disk. No? Then load the screenprint program into memory from cassette and within a few seconds it's modified (including getting rid of the shift/up arrow), moved to high memory and on your disk ready to work! You're advised to then make a new backup working copy of your backup.

Both versions employ extensive error trapping to guard against your bombing the program and losing your data to boot. One method used very effectively is Automatic Prompting to lead you through all of the steps necessary to enter, set up and draw a graph. You're urged to use this option every time.

I mentioned earlier that I was hard-pressed to come up with a set of statistics of my own to graph out. But suppose you're more creative than I. Just what kind of data will *GRAFPLOT* handle? Its author suggests the following applications:

Personal:

- *budgets and actual expenses versus time (days, weeks, months, or years)
- *children's growth curves (height and weight versus time)
- *tax bracket versus income
- *stock and investment performance versus time or interest rate

Business:

- *sales charts
- *marginal cost and marginal profit versus units produced
- *total cost and revenue versus time
- *performance forecasts or production, investments, et cetera

Statistics:

- *scatter plotting of raw data
- *plotting of data versus regression curves
- *evaluation of integrals of complex equations

Scientific and Engineering

- *experimental results plotting
- *removal of noise from data
- *data extrapolation to new experimental conditions
- *evaluation of certain quantities by calculating the area under a curve. (I'd *never* have thought of that one! I'm usually behind the curve.)

If you can think of unique applications, you can even define your own functions with the manual and program leading you along.

Suppose you've already got some files with data you'd like graph plotted. Can you integrate them directly into *GRAFPLOT?* Yes, with reservations. "*GRAFPLOT* can read data from any tape or disk file that has the proper data structure." What that means is that you must use the *GRAFPLOT* format in recording your data. There's a section in the manual suggesting how you can achieve this compatibility.

The documentation—let's call it a manual—isn't too badly put together. I was a little skeptical from the start about its print format of very closely spaced typewritten lines. It just seems a bit too crowded to my eyes. Maybe I'm mellowing, though, because I soon found myself able to wade through it and make some sense out of the format. It's "chock-full-'o'-nuts" to make *GRAFPLOT* easy to use.

Here are the basic questions (with short answers) I asked myself after running through the program several times and getting a good feel for it:

Overall impression? — (Very impressed)
Probable market? — (Small, small business and the naturally inquisitive)
Easy to use? — (Very, if you follow the manual)
Would I buy it? — (Maybe)
Do I recommend it? — (Yes, to anyone with such a need)

I'm very impressed with *GRAFPLOT,* even though it doesn't produce pie—or bargraphs. One last thing: because it uses high resolution's PMODE 4, don't expect to see dazzling colors on the screen. And if you're going to use the hardcopy printouts in business, you might want to enlarge them a bit photographically first. Whether these are shortcomings or not depends on your intended applications.

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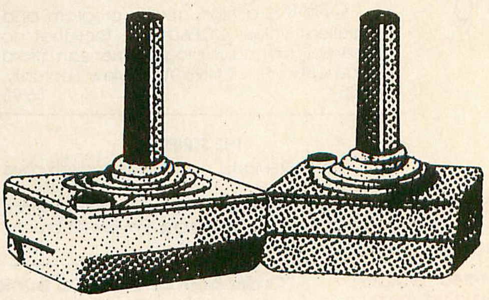

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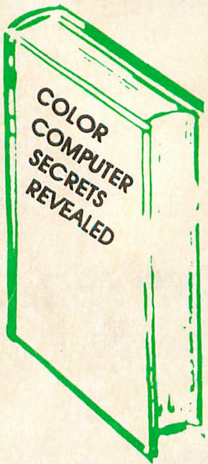

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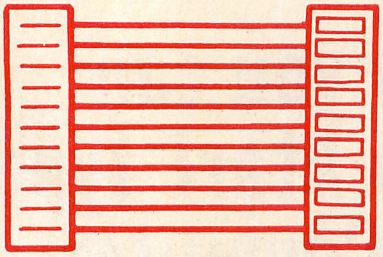

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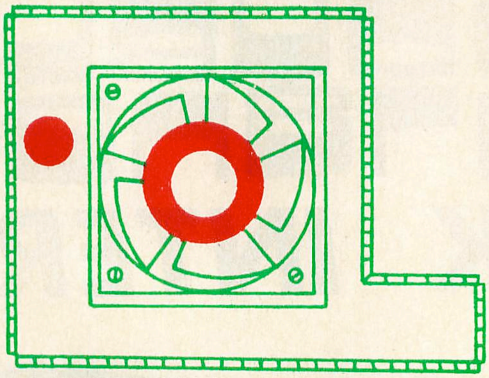

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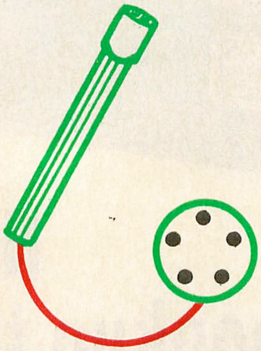

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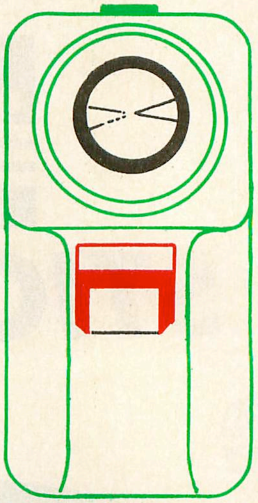

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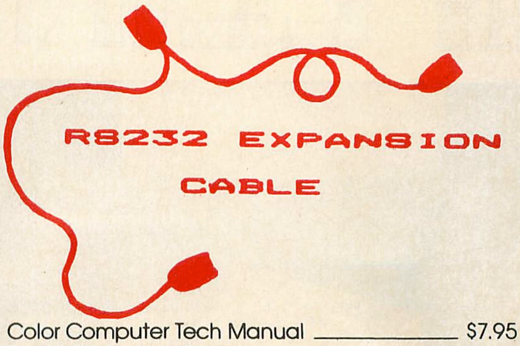

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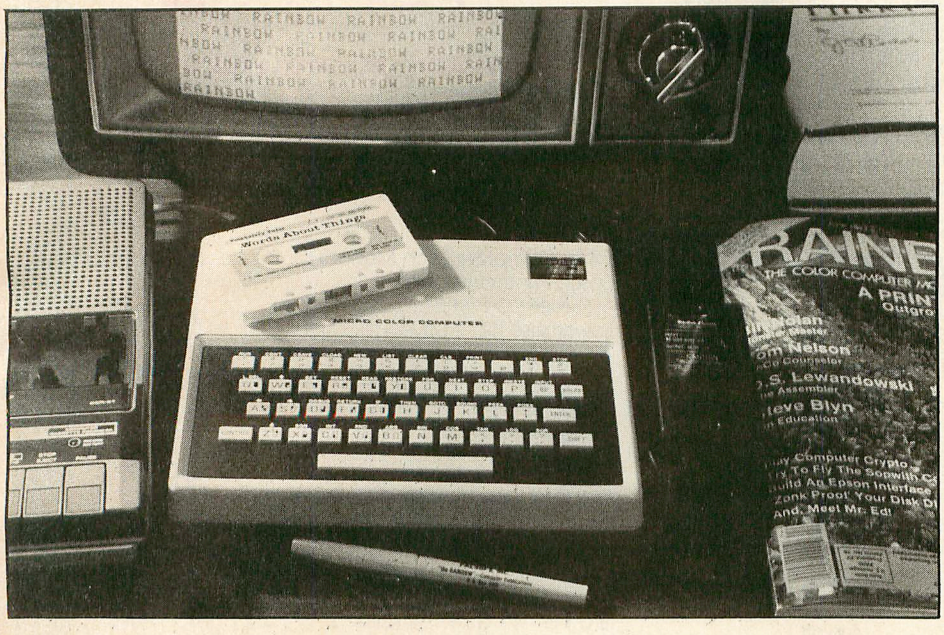

YOU'VE BEEN READING ABOUT the "new" Color Computers on these pages for some time — now we're going to tell you something about one of them.

Yes, it *is* available. It is called the MC-10 and has the now-familiar CoCo logo of red, green and blue rectangles on its white cover (see the picture on this page). Not only is the "PoCo CoCo" (poco means small in Spanish) available now, but it is available for $119.95. That's a very competitive price and when we tell you more about it, you'll see that it looks like the people at Radio Shack have come up with another winner.

From the standpoint of the CoCo Community, the advent of the TRS-80 MC-10 means that there will be a whole lot of people joining us! Here's an ideal "first" computer at a "first computer price." And, while the initial version comes with just 4K, there is reference to greater memory availability and some interesting possibilities for expansion.

The instruction set for PoCo CoCo is something of a mixture of Color BASIC and Extended Color BASIC. And while there are no high-res commands, it seems obvious that high resolution graphics will be possible with machine language programs.

PoCo CoCo arrived here just as we were on deadline, so there may be number of details we will be forced to leave out of this first look-see. But, Dan Downard, our technical editor, promises a full run-down on PoCo CoCo for next month.

In the meantime, here are some first impressions:

The MC-10 has all the string functions available for CoCo, many of the trig operations (like COSine and SINe) and a good amount of other goodies such as RND, ABS, CHR$ and the like. It also has PEEK and POKE, which the non-Extended BASIC CoCo did not originally have.

Along the same vein, it also has multi-dimension array capabilities, which were not included with non-Extended. And, surprise, it sends information to the printer by LPRINT—not PRINT #-2, as does CoCo. This may cause some compatibility problems, but shouldn't be too serious.

Then there's something new: CLOAD* and CSAVE*. These two commands allow you to save and load *arrays* to tape without affecting the rest of the program. A nice addition!

Also obviously different is the keyboard, which sports automatic key-in of BASIC keywords by using a "control" key. Also, the block graphic symbols can be accessed directly from the keyboard.

PoCo CoCo uses a Motorola 6803 microprocessor.This is in the same "family" as CoCo's 6809, but it is not exactly the same. It does use the same PIA chip, so the display looks virtually the same as does its big brother's. All the chips we saw were soldered to the motherboard inside — meaning no sockets as with CoCo. What there is, though, is an "expansion edge card slot" in the back. The manual says this is for extra memory, but Joe Bennett of JARB Software/Hardware says he believes all the address busses come out through this port — which means a lot of things could be added there.

We have to wonder whether they *will* be, though. We see PoCo CoCo as an ideal beginner's machine that will help a person "graduate" to either CoCo or the "Super CoCo" that rumors say will be introduced by Radio Shack some time in the future. In fact, if you read *the Pipeline* last month, you would have seen reference to the computer we are now describing and to the "Super CoCo" we're talking about now.

Also, PoCo CoCo has a full-blown RS-232 serial port and the standard cassette port. It, like CoCo, can run on either channel 3 or 4 and does come with the TV connection box (and appropriate cable) at no extra charge.

At first blush, PoCo CoCo looks to be very similar, technical-wise, to CoCo. The text screen starts at a different place and the top of BASIC is located at a different place in memory. But, these are about the same, so there will have to be some more experimenting before we can be sure whether programs will run "as-is."

There are some differences in the I/O routines, too. For instance, PoCo CoCo does not appear to use the remote control for the tape recorder motor. Also, there may be some differences in BASIC tokens — but programs *typed in* will run the same. New tapes may have to be made to handle programs on that medium. Stay tuned.

All in all, we feel it very reasonable to say that PoCo CoCo is a good addition to the Color Computer family. We believe it will interest thousands and thousands of people in computing — and at a price more attractive than CoCo itself. Once these people get their feet wet in computing, the natural "upgrade" will be to CoCo (or "Super CoCo").

In comparing PoCo CoCo to the other computers in its price range, it definitely comes out far ahead. While Motorola's 6803 is not quite as spiffy as 6809, it is a fine step up from what other low end computers are using. Too, the command set is excellent and the variety of applications seems to be good. And, we *do* hear a memory upgrade will be on its way soon.

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Software Review

DATAMAIL Flexible, Needs Slight U.S. Modification

Oh #$0#%$0! What did I do with that address? Fret no more. Your answer lies in CoCo. That is, of course, if you have *DATAMAIL*.

Upon getting *DATAMAIL* to review, I quickly leafed through the short documentation and *CLOADed* the tape. When CoCo gave me the proverbial OK I simply entered RUN and was greeted with a complete menu which clearly depicted what this program would do for me. A very nice touch.

DATAMAIL allows you to save complete addresses, easily edit them as required, and print them using any of three selectable formats. Name, address, and phone numbers are stored. You can find addresses automatically by typing in a name or semi-automatically using an up/down scan feature.

To use *DATAMAIL* you need the renowned CoCo 16K Extended, a cassette to save your addresses, and a printer is not necessary (you can use the screen listing) but awfully handy.

DATAMAIL is flexible. You can print part of the list, all of the list, a certain address, customize in which you can select which part of an address you want printed, and it has a label feature so you can print labels. For the latter, my better half has great plans. I imagine CoCo will be completely exhausted as we mail out our Christmas cards.

A little more about flexibility. *DATAMAIL* is written in BASIC which makes it easy to modify. If you have read my previous reviews you already know I am very big on customizing any programs I buy and if they are in BASIC, it's that much easier.

DATAMAIL is fast enough to work on my printer and should suit anybody's full speed ahead requests. The only disadvantage I found was we hackers have to key in the addresses (but, we only have to do it once). Come on, you elusive voice recognition software people, get to work. Our tired digits need you!

One of the two changes I could suggest for *DATAMAIL* is a different program for people who live in the United States. They do, in their documentation, tell you how to change the program and it is a very small change. You see, *DATAMAIL* comes from a Canadian company and Canada does not have states or zip codes. They have provinces and postal codes. These two changes are easily made and saved in your customized version of the program. The second change would be an option to print multiple copies of one address for labels. I make my own return address labels and printing them one at a time is a waste of time and energy.

The bottom line must always be—should you buy it? Let us try a short program to give us the answer (be forewarned, you may get a syntax error).

10 IF you would like to maintain a mailing list AND need the flexibility DATAMAIL allows THEN GOSUB to the parenthetical data and let PRICE=$14.95 ELSE GOTO 40.
20 IF you can afford PRICE then GOTO 30 ELSE GOTO 40.
30 GOTO the advertisement and order DATAMAIL.
40 END: REM Whatever your decision I leave it exclusively in your hands.

(THE DATAMAN, Box 431, Sta. B, Hamilton, Ontario, Canada L8L 7W2, $14.95)

—Herbert B. Ridge

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Fraction Math Quiz Has Multiple Defects

Computer owners who are actively involved in education, whether as teachers or parents, seek software which will enhance and extend classroom activities. All too often the "educational programs" are mere drills, which do not utilize the computer's capabilities.

Fraction Math Quiz is another drill program. It presents a menu of choices for seven fraction operations, including fractions to decimals, at five levels of difficulty for each operation. The answers are given in multiple choice format, (which is the best feature of the program) for many students are able to work problems exactly, yet fail to see that something like 13/16 is approximately 3/4. This program provides plenty of practice in "smart guessing," partially intended by the author, but also because the levels of difficulty are not properly thought out. For example, in doing addition, Level I consists of problems which share a common denominator, yet Level II, where the denominators should be in the range of 2 to 6, presents problems of the type 4/9 + 11/14. Because the program is written in BASIC it would be easy to change so that the difficulty levels correspond to actual classroom practice.

The menu contains an eighth choice, "Play Starship Commander." That sounds enticing, doesn't it? Who, on loading in the program, would make any other choice? Unfortunately, when this option is selected, a message appears saying you are in the galaxy and must return to your home planet without the aid of your computer, and will have to calculate the course yourself. You are then returned to the original menu. So sure was I that the author had inadvertently omitted the game that I called to check. I am sorry to say that this message and the return to the menu for the review constitutes the intended diversion. It is against all principles of education to raise someone's hopes for a reward, and then not deliver. This leads me to believe that the program was not child tested before release. My testers (ages 9 to adult) suggest that the whole drill be made into a starship game. The present scoreboard which shows the number right on the first try could be retained.

Unfortunately, the program as it stands is only a drill. No child of my acquaintance has the motivation, persistence, and patience to sit at the computer and perform such drills when the only reward is a simple "Right on, Alfred" for a correct response. In our house, the children were willing to go through the program only because they knew they were participating in a review, and could make suggestions for improvement.

Should you need a drill program for your child, and find the multiple choice format desirable, you should provide the motivation and reward which the program lacks. You could merge a game into it, as the program occupies less than 8K, and this game could be played after a certain number of correct responses and then return from the game to the drill.

For a high school student or adult who is already highly motivated to improve basic fraction skills, and for whom the improvement would be sufficient reward, the advanced levels are a real challenge and definitely improve the ability to approximate answers.

(Creative Technical Consultants, P.O. Box 652, Cedar Crest, NM 87008, $14.95 including s/h)

—Carol Kueppers

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USING GRAPHICS

CIRCLES AND ARCS

16K ECB

By Don Inman
Rainbow Contributing Editor

A point located on a circle can be referenced in terms of Cartesian coordinates (X,Y) or by Polar coordinates (R,ANG). Since most microcomputers screen displays

radius angle

are described in Cartesian coordinates (even though the Y axis is upside-down from the normal notation), a few conversions are necessary when you wish to use Polar coordinates.

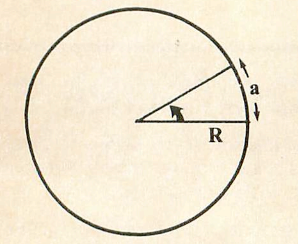
ANGR = ANGD/57.295779

in radians in degrees

X = R*COS(ANGR)
Y = R*SIN(ANGR)

For those who are rusty in mathematics, a radian measure is the ratio of the arc that the angle subtends to the radius of the circle in which it is the central angle.

$\frac{\text{arc}}{\text{radius}}$ or $\frac{a}{R}$

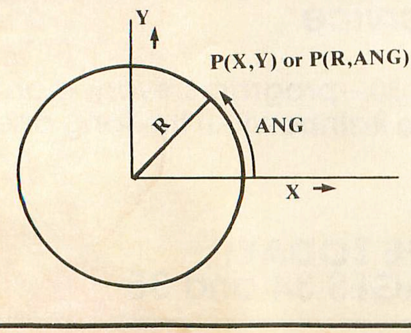


If the arc length (a) equals the radius (R), the angle measure is one radian.

1 radian is approximately equal to 57.295779 degrees

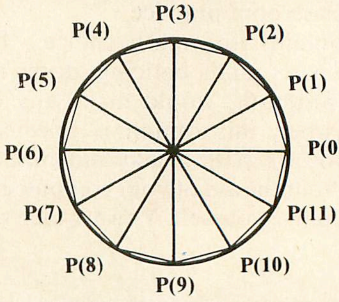
2π radians = 360 degrees

If you know the radius of a circle and a given central angle, the X and Y Cartesian coordinate locations of a point (P), relative to the circle's center, can be calculated with the conversion formulas given above.



The Color Computer has a wonderful BASIC statement, *CIRCLE*, that takes all the work out of plotting a circle. The *CIRCLE* statement can even be modified for height to width ratio (a circle's eccentricity) to produce an ellipse. In this article, we will analyze the circle in order to find out how we can produce more complex curves.

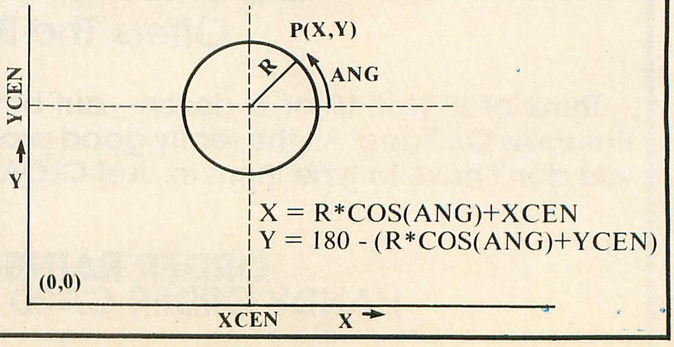
A circle can be thought of as a series of connected straight lines of the same length. At each end of the straight lines is a point. These points are determined by the radius of the circle and the size of the angle used to divide the circle (the central angle). For example, look at a circle with radius R and ANG = 30 degrees.



A simple *FOR-NEXT* loop can be used to calculate the X,Y coordinates for the end points.

```
FOR ANG = 0 TO 360 STEP INC
   X = R*COS(ANG) : Y = R*SIN(ANG)
NEXT ANG
```

Of course, the X and Y values must be adjusted for the distance of the circle's center from the origin of the axes on which they are plotted. The Y value must be corrected for the computer's Y orientation.



X = R*COS(ANG)+XCEN
Y = 180 - (R*COS(ANG)+YCEN)

Our program will be general enough to provide for plotting arcs (sections of circles) as well as complete circles. The parameters used in the program are:

XCEN = X coordinate of the circle's center
YCEN = Y coordinate of the circle's center
R = radius of the circle
SAN = starting angle (in degrees)
EAN = ending angle (in degrees)
INC = angle increment (in degrees)

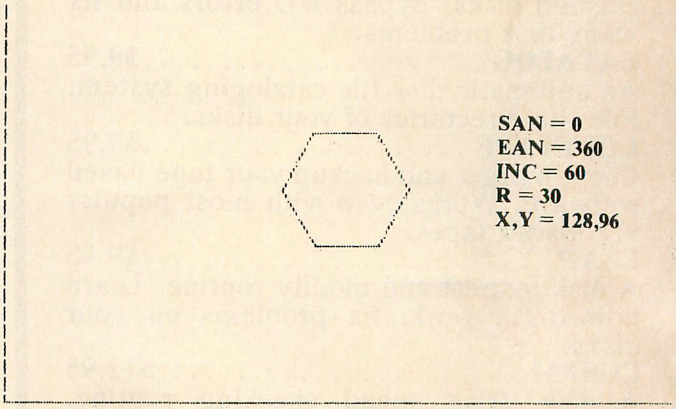
The main program accepts the inputs, defines the parameters, sets up the graphics screen, calls the plotting subroutine, and provides INKEY$ statements for terminating the graphics screen when desired.

The listing:

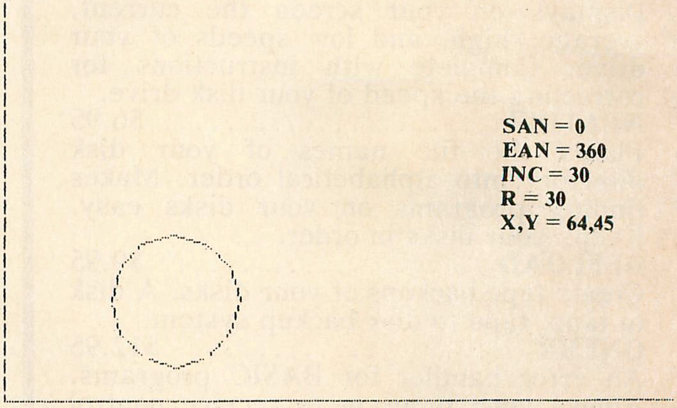
```
100 REM ** CIRCLES AND ARCS **
110 '
120 REM ** INPUTS **
130 CLS
140 INPUT "STARTING ANGLE (DEG)"
;SAN
150 INPUT "ENDING ANGLE (DEG)";E
AN
160 INPUT "INCREMENT (DEG)";INC
170 INPUT "RADIUS";R
180 INPUT "CENTER X,Y";XCEN,YCEN
190 '
199 REM ** SET GRAPHICS **
200 ! 4,1
210 !1
220 ! 1,0
230 ! 0,1
240 '
299 REM ** CONVERT AND GO PLOT *
*
300 PL=INC/57.295779
310 EAN=EAN-INC
320 !(0,180)-(250,180),!
330 !(0,180)-(0,0),!
340 GOSUB 2000
399 REM ** HOLD IMAGE **
400 A$=""
410 A$=INKEY$: IF A$="" THEN 410
 ELSE 130
420 END
430 '
1990 REM ** CALCULATE AND PLOT *
*
2000 FOR N=SAN TO EAN STEP INC
2010 ANG=N/57.295779
2020 X=R*!(ANG)+XCEN
2030 Y=180-(R*SIN(ANG)+YCEN)*.8
2040 XX=R*!(ANG+PL)+XCEN
2050 YY=180-(R*SIN(ANG+PL)+YCEN)
*.8
2060 !(X,Y)-(XX,YY),!
2070 NEXT N
2080 RETURN
```

Here are screen dumps made from several runs of the *CIRCLE* program.

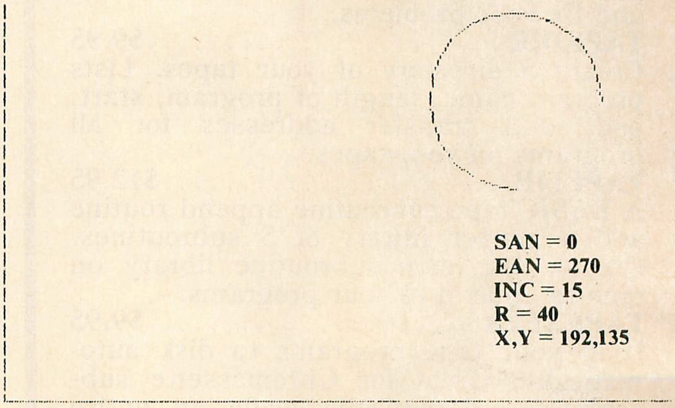
RESULTS **INPUTS**



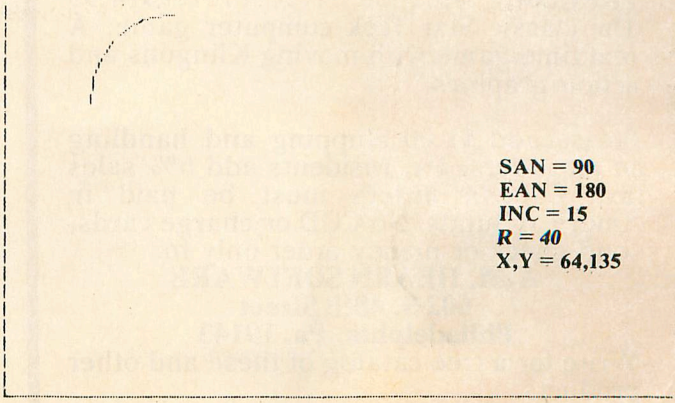
SAN = 0
EAN = 360
INC = 60
R = 30
X,Y = 128,96



SAN = 0
EAN = 360
INC = 30
R = 30
X,Y = 64,45



SAN = 0
EAN = 270
INC = 15
R = 40
X,Y = 192,135



SAN = 90
EAN = 180
INC = 15
R = 40
X,Y = 64,135

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When I made the screen dumps to my printer, the drawings were stretched in the X direction. The program includes a factor of 0.8 to correct for the way the screen stretches things in the Y direction. Therefore, I have found it convenient to include stretch factors as inputs for both X and Y. Then I can control whether I want a good appearance on the screen or on the screen dump. The variables XST and YST are used. For a normal appearance on the video screen, I use XST = 1, YST = 0.8. For a good appearance from the printer, I use XST = 0.8, YST = 1.

The inputs are added to the input section of the *CIRCLE* program.

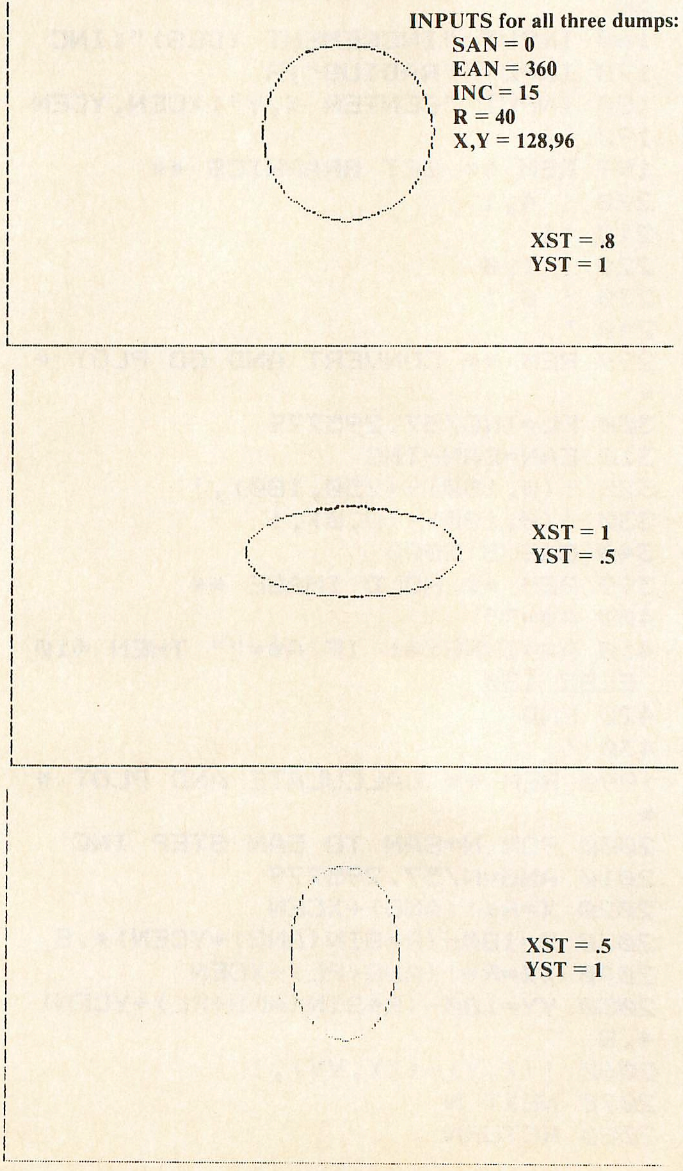
```
183 INPUT “Y-STRETCH”; XST
186 INPUT “Y-STRETCH”; YST
```

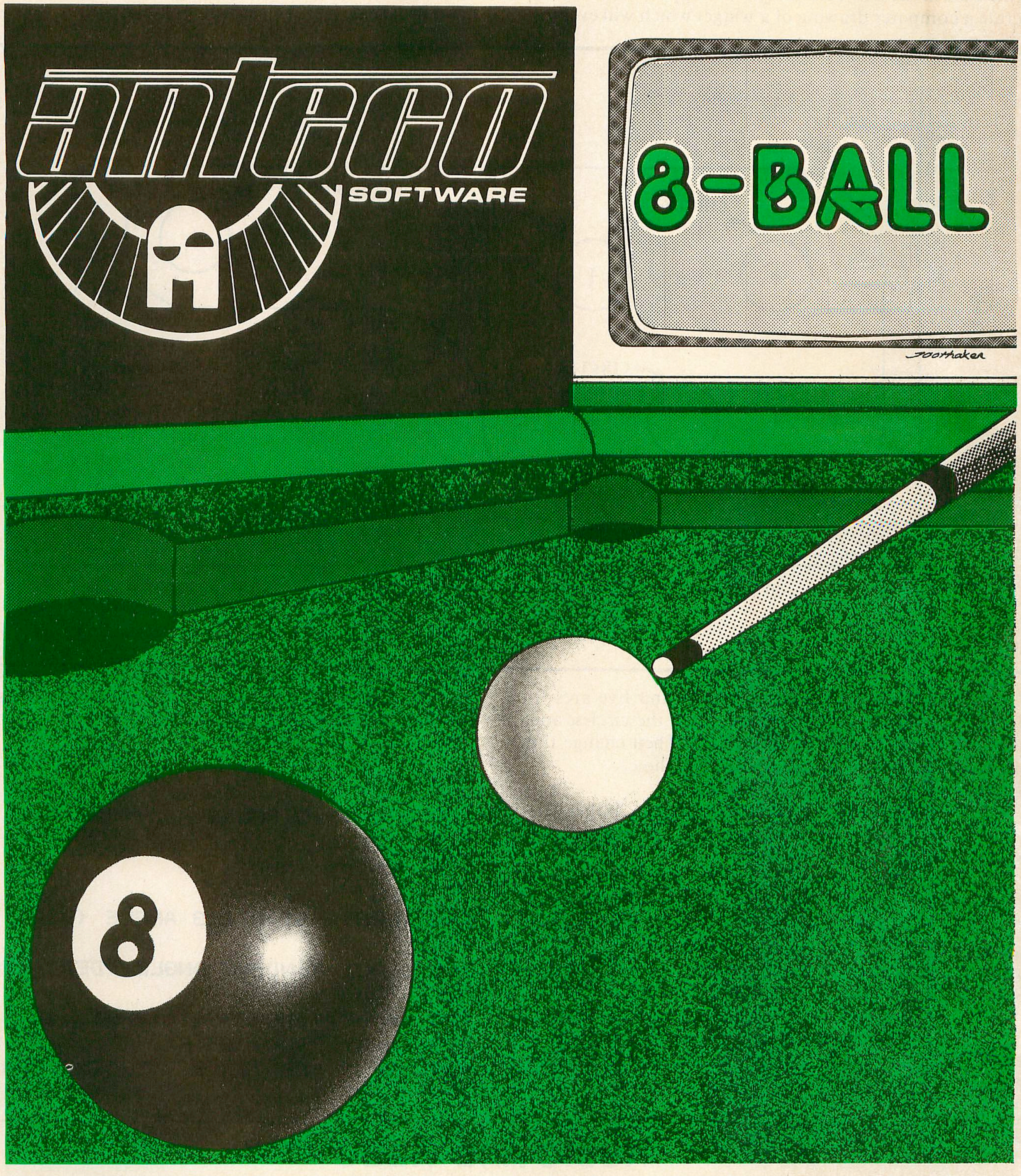
Lines 2020 through 2050 are changed to:

```
2020 X=(R*COS(ANG)+XCEN)*XST
2030 Y=180-(R*SIN(ANG)+YCEN)*YST
2040 XX=(R*COS(ANG+PL)+XCEN)*XST
2050 YY=180-(R*SIN(ANG+PL)+YCEN)*YST
```

These optional inputs allow you to stretch the circle in both directions so that it is quite easy to draw an ellipse of your choice.

Typical Screen Dumps





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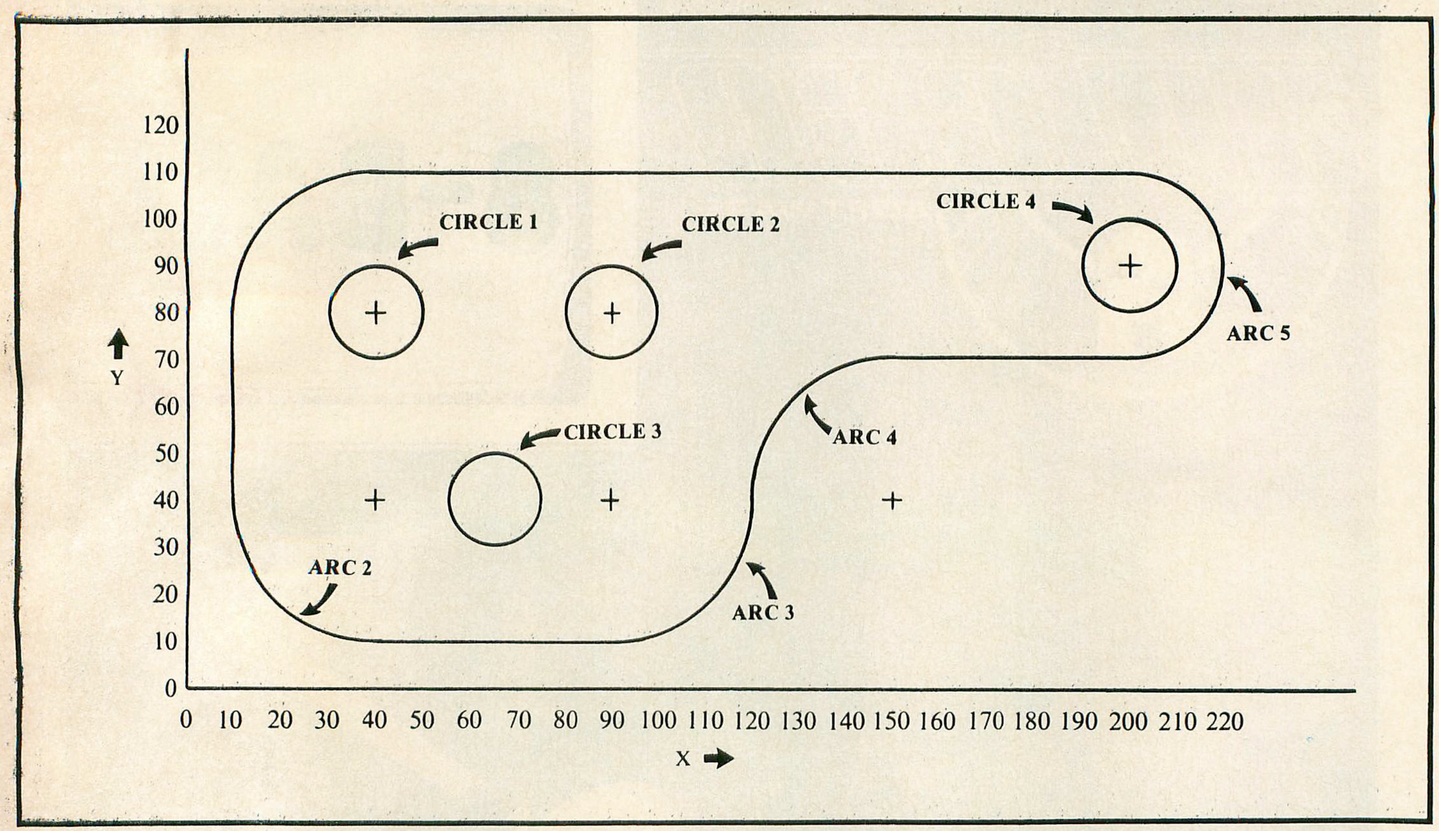
The program *WIDGET* shows an application of the subroutine used in the *CIRCLE* program. Suppose you want to generate a computer drawing of a widget which will eventually be machined, stamped, or produced in some other way. You can use the subroutine in *CIRCLE* but re-write the main program. Our widget will look like this.



You can see that there are four circles and five arcs to draw. *WIDGET* draws the arcs first, then the circles, and finally the straight lines. Try *WIDGET*. Then change the main program to draw the design of your choice.

WIDGET is divided into four modules:

1) The *SCREEN* module clears the text screen. It then sets up PMODE4 with a green background and black foreground. It also draws the X,Y axes.

2) The *DRAW* module uses a *FOR-NEXT* loop to read in the data necessary to draw the arcs and circles. It calls the *CALCULATE AND PLOT* subroutine to do the drawing. After all arcs and circles have been drawn, the straight line portions of the drawing are made. The *DATA* is then restored, and *INKEY$* waits for a re-run if desired.

3) The *DATA* module contains the starting angle (SAN), ending angle (EAN), angle increment (INC), radius (R), and the X,Y coordinates of the center of the circle (XCEN and YCEN).

4) The *CALCULATE AND PLOT* module is the same subroutine used in the first *CIRCLE* program.

The listing:

```
100 REM ** CIRCLES AND ARCS **
110 '
120 REM ** INPUTS **
130 CLS
140 INPUT "STARTING ANGLE (DEG)"
;SAN
150 INPUT "ENDING ANGLE (DEG)";E
AN
160 INPUT "INCREMENT (DEG)";INC
170 INPUT "RADIUS";R
180 INPUT "CENTER X,Y";XCEN,YCEN
```

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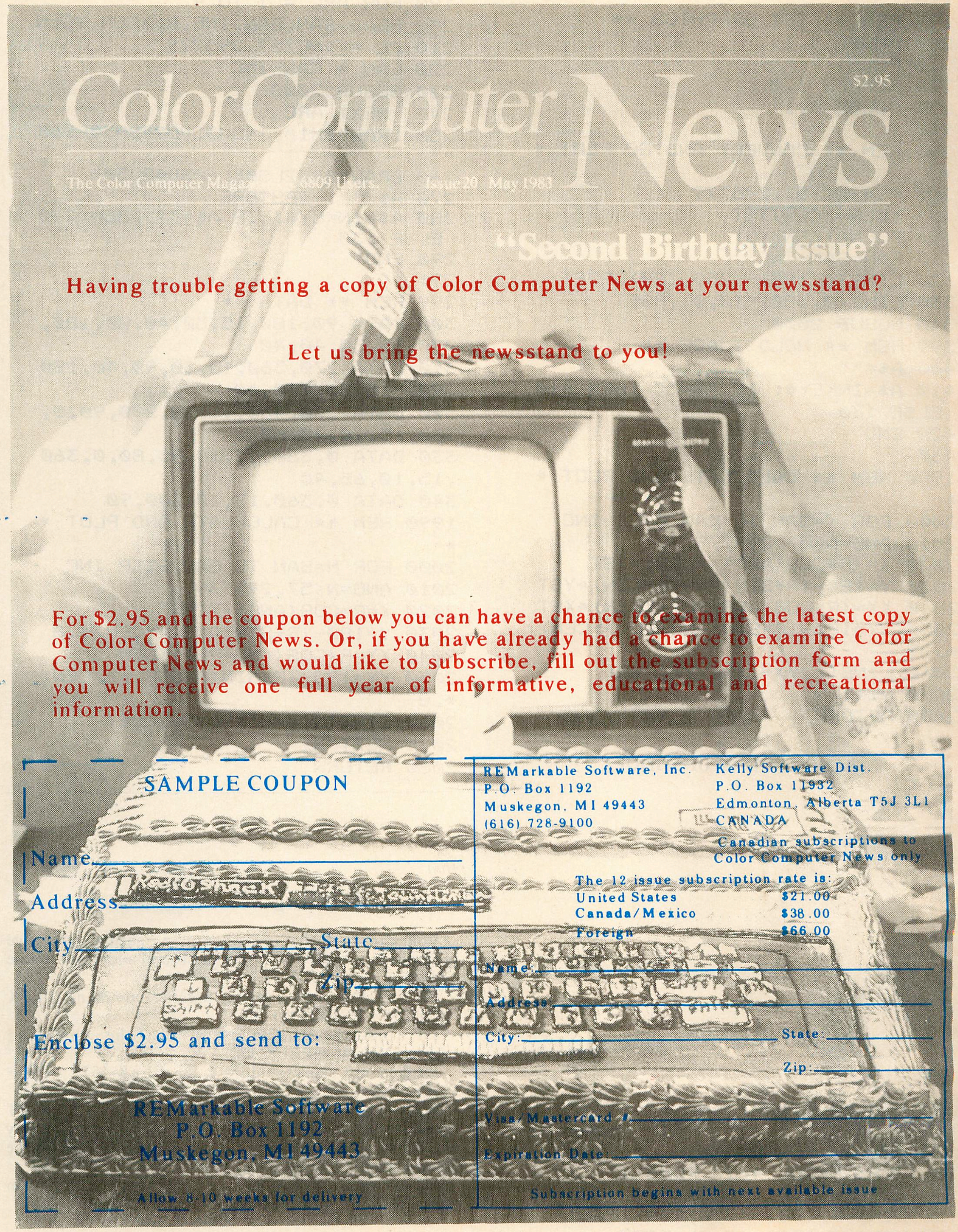

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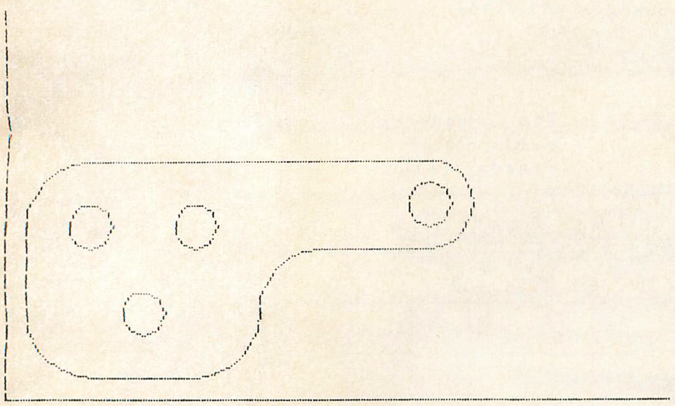
```
183 INPUT "X-STRETCH";XST
186 INPUT "Y-STRETCH";YST
190 '
199 REM ** SET GRAPHICS **
200 PMODE 4,1
210 PCLS1
220 SCREEN 1,0
230 COLOR 0,1
240 '
299 REM ** CONVERT AND GO PLOT *
*
300 PL=INC/57.295779
303 XCEN=XCEN/XST
306 YCEN=YCEN/YST
310 EAN=EAN-INC
320 LINE(0,180)-(250,180),PSET
330 LINE(0,180)-(0,0),PSET
340 GOSUB 2000
399 REM ** HOLD IMAGE **
400 A$=""
410 A$=INKEY$: IF A$="" THEN 410
 ELSE 130
420 END
430 '
1990 REM ** CALCULATE AND PLOT *
*
2000 FOR N=SAN TO EAN STEP INC
2010 ANG=N/57.295779
2020 X=(R*COS(ANG)+XCEN)*XST
2030 Y=180-(R*SIN(ANG)+YCEN)*YST
2040 XX=(R*COS(ANG+PL)+XCEN)*XST
2050 YY=180-(R*SIN(ANG+PL)+YCEN)
*YST
2060 LINE(X,Y)-(XX,YY),PSET
2070 NEXT N
2080 RETURN
```

SCREEN DUMP OF WIDGET



```
100 REM ** WIDGET **
110 '
120 REM ** SCREEN **
130 CLS: PMODE 4,1: PCLS 1
140 SCREEN 1,0: COLOR 0,1
150 LINE(0,180)-(250,180),PSET
160 LINE(0,180)-(0,0),PSET
170 '
180 REM ** DRAW **
190 FOR ARC = 1 TO 9
200 READ SAN,EAN,INC,R,XCEN,YCEN
210 PL = INC/57.295779
220 EAN = EAN-INC
230 GOSUB 2000
240  NEXT ARC
250 DRAW"BM10,148U32BU24BR30R160
"
260 DRAW"BD32L50BL60BD48L50"
270 A$="": RESTORE
280 A$=INKEY$: IF A$="" THEN 270
 ELSE 130
290 END
291 '
299 REM ** DATA **
300 DATA 90,180,15,30,40,80,180,
270,15,30,40,40
310 DATA 270,360,15,30,90,40,180
,90,-15,30,150,40
320 DATA 270,450,15,20,200,90,0,
360,15,10,40,80
330 DATA 0,360,15,10,90,80,0,360
,15,10,65,40
340 DATA 0,360,15,10,200,90
1990 REM ** CALCULATE AND PLOT *
*
2000 FOR N=SAN TO EAN STEP INC
2010 ANG=N/57.295779
2020 X=R*COS(ANG)+XCEN
2030 Y=180-(R*SIN(ANG)+YCEN)*.8
2040 XX=R*COS(ANG+PL)+XCEN
2050 YY=180-(R*SIN(ANG+PL)+YCEN)
*.8
2060 LINE(X,Y)-(XX,YY),PSET
2070 NEXT N
2080 RETURN
```

Hint . . .

Finding ML Addresses

You can find the addresses of a machine language program in memory by PEEKing several addresses. Those addresses are:

To find the start address, use the command PEEK (487)*256 + PEEK(488)

To find the end address, use the command PEEK(126)*256 + PEEK(127)-1

To find the execute address, use PEEK(157) * 256 + PEEK(158)

With all these commands, you must ask CoCo to PRINT the addresses as well as work out the formula. A simple way to do this is add a question mark (?) before each of the commands.

These commands can be used either in a program or in direct mode from the keyboard.

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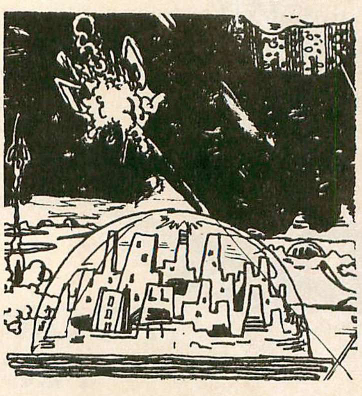

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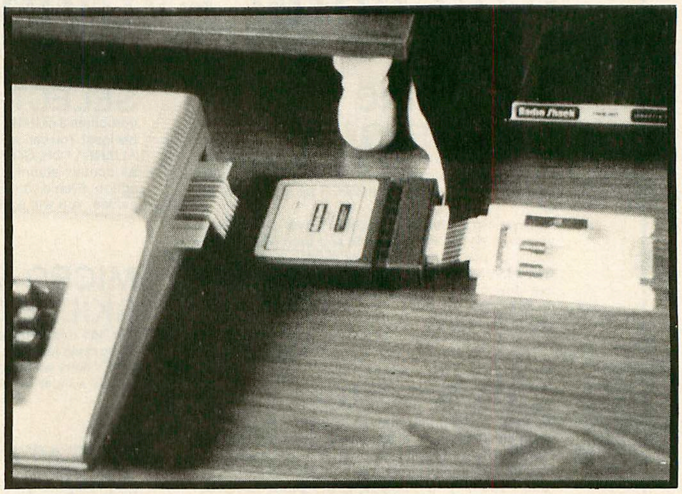
Build A 'Y' Adapter For Your Disk Controller

By Tony DiStefano
Rainbow Contributing Editor

A lot of people have been asking me to explain how to expand their computer without having to spend a lot of money on expansion interfaces, power supplies, and the like. Well, here goes. This is the first of a series of expansion projects for the Color Computer. The emphasis on these projects will be *low cost.* They will be geared toward the experimentalist or the "hacker." They will satisfy the person who is tired of playing games and wants to expand his or her knowledge about hardware by experimenting. All of these projects will be done via the Program Pak connector. A problem arises in trying to experiment when you have disk drive. Those of you that have disk drives really don't like to constantly remove the controller and plug in some experimental board and then replace the controller. And when it comes to using software, having first to save the program on cassette (yuk), unplug the controller, try the software out on the project and then replace the controller is not a very interesting proposition.



Here is the "Y-er" in use with next months project.

Did you ever try to plug two pair of headphones into one headphone jack? You can't. What you have to do is, go to your nearest Radio Shack store and buy a "Y" adapter for your headphones. That is what you are going to do; go to your nearest Radio Shack store and get a "Y" adapter for your disk controller. Well, not quite! You see they don't make a "Y" adapter for a disk controller. What a shame! I guess you'll have to make one. This brings me to the first project for the Color Computer. I call it "The Color Computer Y-er," or is that "wire?" In any case, it will solve the problem of having access to the bus with the disk controller plugged in. Putting this together is not that hard, and not expensive, but you have to remember that this just gives you acess to the bus, it is not a buffered expansion interface. You cannot plug in a ROM Pak and expect it to work. To do that will require some circuitry. That may come later.

The Y-er requires four parts: one project board, Radio Shack No. 276-163; two 40-pin Card Edge Connectors, Radio Shack No. 276-1558, and a 12" piece of 40-wide flat ribbon cable. You can use Radio Shack No. 276-1542. This, however, has a connector on one end. You don't need it and have to cut it off.

If you can get ribbon wire from another source (like I did), do so; why pay more for a connector when you don't have to? As for tools, all you need is the regular set of tools for electronic projects. The only other tool you will need is a four inch vice. You need that to crimp the connector to the

---

(Tony DiStefano is well known as an early specialist in Color Computer hardware projects. He is one of the acknowledged experts on the "insides" of CoCo.)

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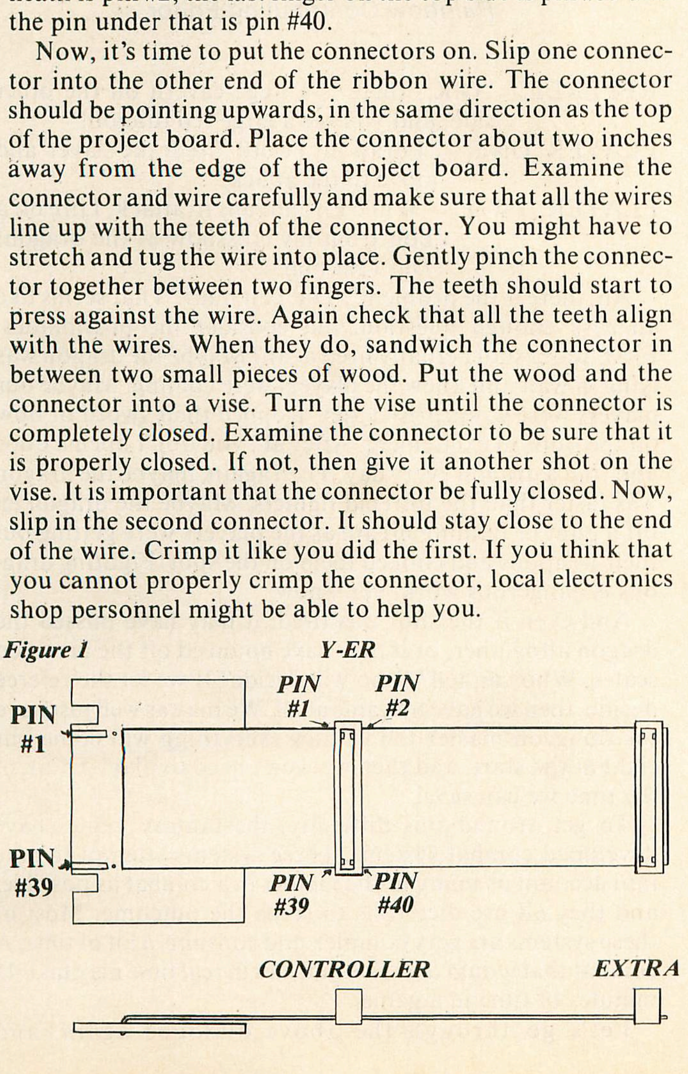
ribbon cable. And that's it—one hour later, you'll have your very own Y-er.

Okay, let's start. Take the project board and cut it in half, at about the "20" mark. You will need the half with the lower numbers. The other half may be used in a later project, but for now, put it aside. With a sharp knife, separate one end of the ribbon wire into individual wires about one inch long. Strip about 3/16 inch of insulation off of each wire. Tin each wire with solder. This is where the tricky part starts. This has to be done just right. Hold up the ribbon wire by the stripped end and let the rest of the wire hang down. Starting from the right hand side, bend the ends of the wire alternately forward and backward. The first one on the right side goes away from you. This divides the ribbon into two sections. Counting from right to left, the odd numbers are away from you and the even numbers are close to you. The top section and the bottom section. The top section will solder to the top (component side) of the project board and the bottom will solder to the bottom (copper side). You do this by soldering the bottom side first. The first wire on the right goes into the hole just below the first finger on the right. That means that it will solder to the copper side. The second wire goes on the first finger on the component side directly above the first wire. Then the third wire goes under the second finger to the finger on the copper side. The forth wire goes on top of the second finger and so forth until all of the wires are done. The last wire on the left goes on the top (component) side of the last finger. From now on this is known as the top side. The first finger on the right side is pin #1, the pin directly underneath is pin #2, the last finger on the top side is pin #39 and the pin under that is pin #40.

Now, it's time to put the connectors on. Slip one connector into the other end of the ribbon wire. The connector should be pointing upwards, in the same direction as the top of the project board. Place the connector about two inches away from the edge of the project board. Examine the connector and wire carefully and make sure that all the wires line up with the teeth of the connector. You might have to stretch and tug the wire into place. Gently pinch the connector together between two fingers. The teeth should start to press against the wire. Again check that all the teeth align with the wires. When they do, sandwich the connector in between two small pieces of wood. Put the wood and the connector into a vise. Turn the vise until the connector is completely closed. Examine the connector to be sure that it is properly closed. If not, then give it another shot on the vise. It is important that the connector be fully closed. Now, slip in the second connector. It should stay close to the end of the wire. Crimp it like you did the first. If you think that you cannot properly crimp the connector, local electronics shop personnel might be able to help you.

Figure 1



Your "Y-er" should now look like the one in Figure 1. Before you go plugging this thing in, you should run a few tests. The first test is to determine if all the wires have continuity. This is where the other half of the project board comes in. Plug the board into one of the connectors. With an OHM meter, check that all the wires show continuity between the two ends. Make sure that they all line up! Pin #1 on one should be pin #1 on the other. That is important: reversed wires can cause a disaster. Next check the continuity of the other connector. If all is well there is one more thing to check before you can use the "Y-er." You must check for shorts between the pins. Put one lead of the OHM meter on pin #1. Place the other lead on each of the surrounding pins one at a time. All of the readings should show high. There should not be any resistance between any pins. After all this checks out, remove the flux left behind when you soldered the wires to the project board. This can be done with flux cleaner. If you don't have any, an old toothbrush and lighter fluid will work. You might have to get down to a little bit of scrubbing. If you bought the Radio Shack connectors you will have to do a little trimming in order for the disk controller to fit in correctly. A small knife will do the trick. Cut deep enough that the controller fits in all the way.

After you feel sure beyond the shadow of a doubt that there are no shorts and no opens it's time to try it out. With the power off, plug the "Y-er" into the Color Computer's cartridge slot. Make sure it is in tight. Turn the computer on. If all is well, then turn it off again and plug the controller into the first connector. Turn it on and there you are, you have access to the bus with the controller plugged in. Right now you don't have anything to try it out with, but next month my project is a parallel printer port. For now try plugging the controller into the other connector to make sure that it works.

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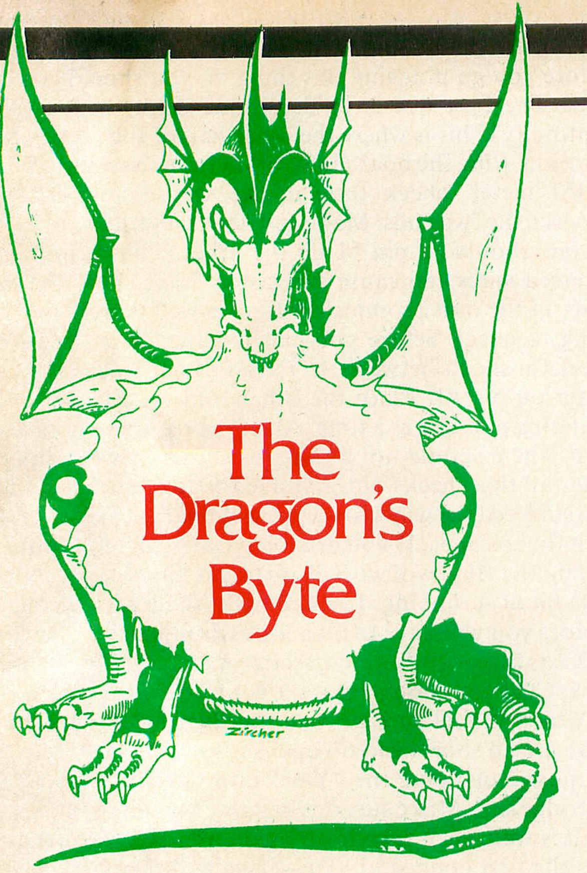

The Dragon's Byte

Ready For Combat? Draw Your Crossbows!

By Bill Nolan
Rainbow Contributing Editor

Welcome to the Dragon's Byte! In past columns we have talked about creating characters and monsters for fantasy games. We have also spent some time on record keeping systems for keeping track of the progress of a character.

For those of you who are not familiar with fantasy role playing games, the play consists of creating an imaginary character and then pretending to be that character while exploring old dungeons, fighting with monsters, or traveling to distant lands where strange and wonderful things can be found. You could compare it to writing a play by giving each actor a character to work with and letting them make up the dialog as they went along.

Needless to say, a game of this kind can be very complex. One of these games has five hard cover books of rules to explain the play, and the rules still fall short of fully explaining every possible situation. To handle this kind of problem, and also to have someone available to act out the parts of all the bad guys and monsters, a special game position was created.

This special person is called the dungeon master, referee, or game master, and they keep track of where everyone is, how they are doing, and myriad other facts and figures. Several of our previous articles have been addressed to the need to computerize all that data.

This time I want to begin discussing combat. In a fantasy game combat comes up like this:

PLAYER ONE: "I open up the door and go into the room."

REFEREE: "O.K., there is a huge cavern on the other side, and you see a large red dragon!"

PLAYER ONE: "I draw my sword 'firedrake slayer' and move to the attack."

PLAYER TWO: "While Elrond runs to attack, I fire off a bolt from my crossbow at the dragon! Did I hit him?"

Ah, there is the problem! "Did I hit him?" That seems like an easy enough question, but consider the possibilities. First, was a shot actually fired at all? Maybe the dragon was lying in wait and knew the players were coming. Maybe our players were so surprised they dropped their sword or bow on the floor in excitement. After all, you don't open a door and find a dragon every day. Then again, maybe the dragon was faster than the intrepid fighters. Maybe the dragon let off a gout of flaming breath as the players were getting out their weapons and cooked them on the spot. Fighting dragons is dangerous work, you know!

And even if the shot was fired, it may have missed the dragon altogether, or it may have bounced off the armored scales. Who can tell? Who will decide? If we let the referee decide, then we have no game at all. We may as well just have the dungeon master tell us how everything will come out right at the start, and then we won't need to play! Think of the time we can save!

To get around this difficulty, the fantasy games have developed combat systems. These systems attempt to take into account as many of the factors in a combat as possible, and they all use dice rolls to settle the outcome. Most of these systems are very complex and consume a lot of time. A combat that would take five minutes in real time may take 45 minutes of time in a game.

Let's go through the above dialogue again, and

(Bill Nolan is co-owner of Prickly-Pear Software, and teaches Programming in BASIC at Pima College in Tucson, Arizona.)

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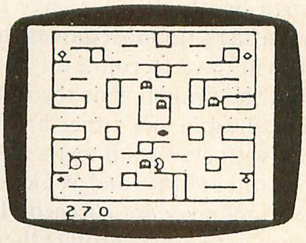

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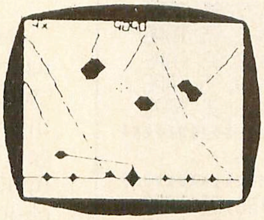

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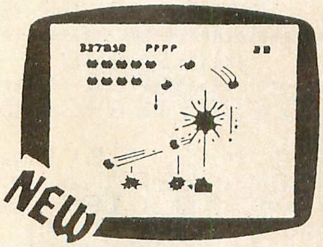

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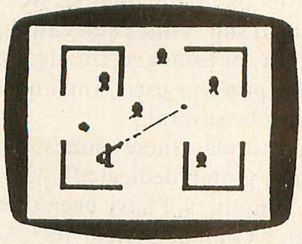

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you'll see what I mean.

PLAYER ONE: "I open up the door and go into the room."

Did the door actually open? Maybe it was locked or stuck. We roll a die to find out. If it was locked or stuck, additional dice will have to be rolled to see if it was successfully picked or kicked open. Only after all this has been done can we safely assume that the party enters the room.

REFEREE: "O.K., there is a huge cavern on the other side, and you see a large red dragon!"

That's nice. But, dragons have a reputation for sleeping a lot, so we have to roll a die to see if this particular dragon was awake or asleep. Let's assume this one was awake. Was it startled or surprised? Were any of the party members surprised? We have to roll a die for each character and monster involved!

PLAYER ONE: "I draw my sword 'firedrake slayer' and move to the attack."

PLAYER TWO: "While Elrond runs to attack, I fire off a bolt from my crossbow at the dragon."

Before any of this can be decided, we have to find out which side gets the first attack. In most games this is called "initiative." Each side will have to roll a die to determine this. Let us pretend that the dragon wins the initiative and gets to attack first. The dragon can either breathe on the fighters or it can attack with claws and teeth. Which will it choose? You guessed it, roll another die! Whichever choice the dragon makes, its attack may not succeed. The dragon could miss, or the players' armor may protect them, so more dice must be rolled. If the attack does succeed, dice must be rolled to find out how much damage was done.

If any players survive the attack of the dragon, then we get to:

PLAYER TWO: "Did I hit him?"

Gee, my dice are getting a little worn on the corners, and we are still only getting started! To make matters worse, after we roll a die, we have to look up the number we rolled on a large table to find out the result. This result can then be modified by the armor worn by the attackee, the strength of the attacker, what kind of weapon was used, and any magical spells in effect. (There may be several.)

You have to be dedicated to play these games. So far, about five million people have gotten dedicated!

Naturally, since I collect computers, I have been thinking of how to design a computer combat system to take the drudgery out of all this fighting. A big advantage of a computer is that you aren't limited to dice of 6 or 10 or 20 sides. You can have any number of sides you want, and that gives you much more flexibility in designing your combat system.

First, however, a word about the random number command on the Color Computer. RND(n) will return a number from 1 to the number "n." If "n" is 1 or 0, the number returned will be a decimal number larger than 0 but smaller than 1, like .12345678. If the number "n" is a minus number, it will reseed the random number generator with a different seed for each minus number.

Hold on a minute! What was that last? Well, the random number generator is what the computer uses to calculate its random numbers. For example, do a cold start. (That means turn your computer off, wait 15 seconds like the manual says, and turn it back on.) Now type:

```
10 FOR X=1 to 10:PRINT RND(100):NEXT X
```

When you have this line typed into the computer and have entered it, type RUN and press ENTER. If you made no mistakes, a row of 10 numbers from 1 to 100 will appear

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COLOR GRAPHICS EDITOR

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AT LAST, a graphics drawing program that is USEFUL in writing programs that use graphics.

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down the left side of the screen. Write those numbers down, in the order they appear. Now, do another cold start, type in the same line all over again, and *RUN* the program one more time. How about that? The SAME 10 numbers! This is a problem in a game. What fun is a game if you can predict what the next roll of the dice will be? The answer to that depends upon whether you're playing Monopoly with friends or craps in Vegas.

What we are getting are PSEUDO-random numbers, and being able to repeat the same series of numbers is very useful in some statistical applications. That won't help our game, though. We need unpredictable numbers. Try the above one line program again, but this time add a line 5 before you *RUN* it. Remember to do a cold start first.

```
5 X=RND(-100)
10 FOR X=1 TO 10:PRINT RND(100):NEXT X
```

This is an improvement. Now we have different numbers. Do it again (remember the cold start with -200. See, different again. That's what we mean when we say that "minus numbers reseed the random number generation." The problem here is that if you use the same minus number you always get the same result. Try the above again with -100 (cold start) and you will see what I mean.

What we need is an unpredictable minus number. The timer is quite unpredictable! After all, it changes 60 times a second, and that may well be the solution. If we change line 5 above to be:

```
5 X=RND(-TIMER)
```

the resulting numbers will become unpredictable. As we continue with our combat system then, we will have to remember to insert the above line into the beginning of our program.

Before we get off this subject, let me give you another way to insure unpredictable numbers. Since we get the same series of numbers from each seed, we can either change the seed, as we did above, or jump into our series at an unknown point. The program below does both!

```
10 X=RND)-TIMER)
20 CLS0
30 PRINT @ 202, "RANDOMIZING";
40 PRINT @ 293, "PRESS ANY KEY TO GO
      ON";:K$=INKEY$
50 IF INKEY$="" THEN X=RND(0) :GOTO 50
60 CLS:FOR X=1 TO 10
70 PRINT RND(100)
80 END
```

In line 10, a new "seed" number is chosen. Then, in line 50, random numbers are chosen over and over again an unknown number of times until you press a key to go on. I have found the above combination to give the best results in BASIC game programs. It isn't necessary to print the "randomizing" message on the screen, or even create a special routine for this. You can simply insert the RND statement into the middle of an INKEY$ loop somewhere in your program.

Next month we will get into writing the program to computerize a combat system. This is going to be a very complex program, so we'll see how much fits in one column. Meanwhile, give some thought to ideas you would like to see covered in future columns and let me know what you want. Happy Anniversary, *Rainbow*!

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Wrapping Up Our Communications Word Processor

By Richard A. White
Rainbow Contributing Editor

Last month, we began writing a Communications Word Processor program to generate, off-line, text that could be loaded and sent by *COLORCOM/E* or other terminal packages that support line by line transmission of a previously loaded file. Special program features include keeping line counts and a wordwrap feature to move text from overlength lines to the next line. We also want an easy-to-use editor and need printer and cassette or disk file handling ability. The program is modular. That is, specific line numbers were predefined for the various functions we knew had to be included. Main Menu starts at 1000, an easy-to-remember line if you get an error or break the program and want to reenter without losing your data. Following is Table 1 which lists all modules used.

TABLE 1

Commwp Modules And Number Block Assignments

Lines	Module	Comments
5—99	Subroutines	Frequently called subroutines used by more than one routine.
100—199	Enter Message	Enter lines at bottom of message.
200—249	Edit	Phrase substitution editor.
250—299	Insert	Put new text between existing lines.
300—399	Wordwrap	Cut over limit text and add to next line.
400—500	Delete	Delete line and renumber those above.
500—600	Copy	Copy line into temporary variable and insert at new location.
600—700	Printer	Hard copy for proof or file.
900—1000	Save/load	Disk or cassette option.
1000—1050	Main Menu	Select primary functional choices.
1050—1100	Configuration	Configure limits to specific bulletin board requirements.
2000—2100	Initialization	Read strings and enter key variables into table.
10000	Auto-save	Run past leader and save two copies to tape.
11000	PCLEAR1	Avoid SN error.

(Richard White has a long background with microcomputers and specializes in BASIC programming. With Don Dollberg, he is the author of the TIMS data base management program.)

Last month, we discussed initialization, the Main Menu, bulletin board limits, the program save routine and wordwrap. Focus was on program logic and ways to implement the logic in BASIC. It is now time to do the same thing with the heart of the program, the text entry and editing routines. My assignment is to explain them to you. Your assignment is to understand them well enough that you can make some improvements on your own or use parts of the code in your own programs. Certain objectives we stated last month determine how the text entry sections called from it are to be written and need to be reviewed.

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1) Display lines used and lines left. As finally implemented, this became lines used and lines allowed.

2) Allow user to scroll up or down through the message using the arrow keys.

3) Edit or delete the bottom line displayed.

4) Be able to insert a new or copied line between others.

5) The editor will be a phrase substitution type, where the user types the material to be removed and then the new text.

6) Provide wordwrap so lines longer than the limit can be typed and the excess from the last space before the limit will be moved into an additional line or added to the next line as appropriate.

7) In addition to arrow key control, how about other control keys like "T" for top of message, "B" for bottom of message and "G" to *GOTO* a particular line. "G" was not implemented due to screen space limits.

The text entry section code will use certain BASIC routines that could be used again elsewhere in the program. The plan was to identify these and put them in low line numbered (and quickly found) subroutines. The result is that the text entry code starting at line 100 is fairly short.

```
8 PRINT@96,STRING$(32,CHR$(163))
;:IFI>1THENPRINTA$(I-2)
9 PRINTA$(I-1):PRINTA$(I):RETURN
10 PRINT"LINE#"I" LINES"IH" ALLO
WED"LM,MO$" mode    ^<ENTER>=COMM
ANDS",,:RETURN
```

```
100 MO$=" enter":CLS4:I=IH+1:GOS
UB10:GOSUB8:LINEINPUTC$:IFLEFT$(
C$,1)<>CHR$(94)THENIFA$(I)=""THE
NA$(I)=A$(I)+C$:ELSEA$(I)=A$(I)+
" "+C$ELSE105
```

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Since some subroutines will be used by a number of calling routines, we send the calling routine name in MO$ which starts Line 100. The screen is cleared and the line counter is incremented. If there are no lines yet in the message, IH = 0 and I goes to 1. Subroutine 10 writes a header showing current line, I, number of lines already entered, IH and lines allowed. The "," after LM moves the print location to the second line where the calling mode is printed along with the reminder "up arrow." Followed by *ENTER* you will shift to Command Mode for scrolling through the message and accessing other functions like Edit, Insert and Delete.

Text is entered using *LINE INPUT* C$ so there are no restrictions on keyboard characters that can be entered. When the entry is completed, a nested *IF — THEN IF — THEN — ELSE — ELSE —* construction is encountered. If the condition after the first *IF* is not true, control is passed to code following the second *ELSE*. If that condition is true, the second *IF* is evaluated and final action will be either the code following the second *THEN* or first *ELSE*. Nested conditionals can be tricky. Perhaps the following statement will help.

> *IF* (Test 1) *THEN* (if Test 1 is true) IF (Test 2) *THEN* (if Test 2 is true ACTION A) *ELSE* (if Test 2 is false ACTION B) *ELSE* (if Test 1 is false ACTION C).

Program clarity considerations more than machine capacity determine how many *IF THEN ELSEs* you nest. Debugging *IF THEN* statements can be tricky, which is another reason to consider alternate ways. Weird things can happen if there are errors in test code after the *IF*. BASIC is looking for only a true or a false indication at this point and messed up test code may not return a syntax error to help you pinpoint a problem. It just won't work right. This can happen in any IF THEN statement, it's just more trying in more complex situations. Let's look at what the code in line 100 is saying.

> *IF* (no up-arrow at beginning of C$) *THEN IF* (A$(I) is null) *THEN* (A$(I) = C$) *ELSE* (A$(I) = A$(I) plus a space plus C$) *ELSE* 105.

```
102 IH=I:IFLEN(A$(I))>CL GOSUB30
0:IFLEN(A$(I+1))>CL THENI=I+1:GO
TO102:ELSE100ELSE100
105 I=I-1
110 PRINT@480,"COMMAND ?";:GOSUB
12:ONZ GOTO200,250,400,500,1000:
Z=Z-5:CLS3:FG=1:ONZ GOSUB14,16,1
8,20:FG=0:GOTO110
```

Line 102 clarifies why we would need to test for A$(I) being null. The user is free to enter as much text as desired in a line and wordwrap is called in 102 if text is longer than maximum line length. Wordwrap cuts off enough of the left of C$ to fill A$(I) and RETURNs. In line 102, one is added to I and wordwrap is again called if needed until C$ is used up. Again nested IF — THEN — ELSE statements are used, but the false action for both *IFs* is to go to 100. Still, two *ELSE* statements are required, one for each IF. In this special case where actions are identical, 103 *GOTO* 100 can be substituted for the pair of *ELSEs*.

If the up-arrow is entered, it is assumed that there is no text, I is reduced in 105 and the program goes into the command mode in Line 110. Subroutine Line 12 is called to print the command options, get the letter keystroke and convert it to a number that is returned in Z. In some cases,

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like scrolling with the arrow keys, we want to return to 110 to repeat the action or make another choice so a subroutine call is desirable. In other cases, like going to the Main Menu, any return will be from choices at that routine and *GOTO* action is appropriate. Line 12 was written so that the *GOTO* choices are returned as Z=1 through 5. The ONZ *GOTO* comes first in 110 and if Z is greater than 5 no action is taken, the program subtracts 5 from Z and does an ONZ *GOSUB*. When control comes back from the subroutine, we loop back and do 110 again.

```
12 PRINT@32,"tOP  bOTTOM  UP/DOW
N ARROWS eDITiNSERT  dELETE  cOP
Y  mENU       ";:IFFG=1THENRETURN
ELSEFORJ=0TO0:Z$=INKEY$:J=(Z$=""
):NEXT:Z=INSTR("EIDCMTB"+CHR$(94
)+CHR$(10),Z$):IFZ=0THEN12ELSERE
TURN
```

I like Line 12 both for what it does and how it does it. First, it prints the Command Mode options. Next it checks if flag FG=1. If so, it returns to the calling routine. Next it gets the letter keystroke and converts it to a number using the *INSTR* routine we discussed last month. Finally, it checks for invalid entries, Z=0, and goes around again in that case. As written, a lower case letter is an invalid entry. In any word processor where the user is likely to be using lower case as not, failure to allow lower case command strokes is intolerable. Your assignment, should you decide to accept it, is to rewrite line 12 and 110 if need be to accept lower case commands. There are at least two ways to do this. One involves changes in 12 and 110. The other splits 12 into two lines (12 and 13) and does not require changing 110. It's things like this that cause Versions 2.0 and 3.0 to be written.

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Coming back to the flag FG=1, this was set in 110. If the action called for involves scrolling the screen or moving to the top or bottom, one of the subroutines 14, 16, 18 or 20 is used. These use subroutines 8 and 10 to rewrite the screen. Since 12 is called by 110, its use in the other subroutines is only to get the command test up quickly so the eye does not notice what 10 wrote on text lines 2 and 3 while the message text is being written. Indeed, the GOSUB 12 in line 110 might better be in line 105. I leave you to experiment.

The subroutines in lines 14 to 21 do the scrolling and Top and Bottom functions. Pay attention to I and you can figure out how they work.

```
14 I=1:GOSUB10:GOSUB12:GOSUB8:RE
TURN
16 I=IH+1:GOSUB10:GOSUB12:GOSUB8
:RETURN
18 IFI>1THENI=I-1
19 GOSUB10:GOSUB12:GOSUB8:RETURN
20 IFI<IH THENI=I+1
21 GOSUB10:GOSUB12:GOSUB8:RETURN
```

It may seem that we have spent an inordinate amount of space on one block of code. But, there was a lot to think about in those few lines. The remaining text functions follow a bit different pattern in that the subroutines pertaining only to that function are in the same code block, following the main routine, and not at the front of the program. You can compare text entry and edit and decide which way you like best or if you even care. Note that I did not follow my original intent, but this would prevent me from going back and doing some rewriting once the program was working to my satisfaction.

I think a phrase substitution editor is the next best thing to a full screen editor and is much easier to implement in a BASIC program. After writing the heading and text lines, the program asks for the "old phrase." This can be any combination of characters that occurs in the last line of text. This occurs in Line 200. There is also the test for no entry and for the up-arrow. Either of these provides escape. Since one may want to make a number of changes in a line, or even change a change just entered, the option to change with the escape is necessary.

```
200 MO$="  edit":CLS5:GOSUB10:GO
SUB8:LINEINPUT"old phrase  ";A$:
IFA$=""ORA$=CHR$(94)THEN220
210 F=INSTR(A$(I),A$):IFF=0THENC
LS5:GOSUB10:GOSUB8:PRINT"phrase
not found":LINEINPUT"old phrase
";A$:IFA$=""ORA$=CHR$(94)THEN22
0ELSE210
215 LINEINPUT"new phrase  ";B$:L
1=LEN(A$(I)):A=LEN(A$):C$=LEFT$(
A$(I),F-1):L2=LEN(C$):L3=L1-(A+L
2):Q$=RIGHT$(A$(I),L3):A$(I)=C$+
B$+Q$:GOTO200
```

In Line 210, the starting position of the old phrase in the line is found. If the exact combination of characters is not found, *INSTR* returns a zero, we reprint the screen with the message "phrase not found" and the invitation to re-enter the old phrase. A lot of Line 200 code is duplicated, mainly so the message "phrase not found" will be correctly posi-

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```
10PRINT"EXAMPLE": FORX=ATO M:FORY=STO
P:Z=X+Y:PRINTZ:NEXTY:NEXTX
```

```
Into this: – 10 PRINT "EXAMPLE":
                 FOR X = A TO M:
                    FOR Y = S TO P:
                       Z = X + Y:
                       PRINT Z:
                    NEXT Y:
                 NEXT X
```

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tioned. When the old phrase is found, the program moves to 215 to get the new phrase. Then the text line is taken apart into the portion left of the old phrase, C,$ and the portion to the right of the old phrase, Q$. It is then put back together with the new phrase in the middle as A$(I) = C$ + B$ + Q$.

```
220 PRINT@480,"command ?";:GOSUB
230:ONZ GOTO200,100,1000:Z=Z-3:C
LS5:FG=1:ONZ GOSUB242,244,246,24
8:FG=0:GOTO220
230 PRINT@32,"tOP  bOTTOM  UP/DO
WN ARROWS      eDIT    cURRENT MES
SAGE   mENU    ";:IFFG=1THENRETUR
NELSEFORJ=0TO0:Z$=INKEY$:J=(Z$="
"):NEXT:Z=INSTR("ECMTB"+CHR$(94)
+CHR$(10),Z$):IFZ=0THEN230ELSERE
TURN
242 I=1:GOSUB10:GOSUB230:GOSUB8:
RETURN
244 I=IH+1:GOSUB10:GOSUB230:GOSU
B8:RETURN
246 IFI>1THENI=I-1
247 GOSUB10:GOSUB230:GOSUB8:RETU
RN
248 IFI<IH THENI=I+1
249 GOSUB10:GOSUB230:GOSUB8:RETU
RN
```

Line 220 does the same thing as Line 110 in text entry and Lines 230 to 249 are similar to 12 to 21 that were used in text entry. The difference is that the choices in Line 230 are different than those in Line 12 and all subroutines need to be rewritten using 230 rather than 12 as the subroutine call.

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The insert routine starting at line 250, the delete routine starting at line 400 and the copy routine at line 500 are built on structures similar to edit which we discussed above. Copy may be viewed as a special case of insert since the source of the text is string memory rather than the keyboard. In each case we need to move strings and we do this by moving the address of the string in the variable table, rather than copying the string itself to a different place in memory.

```
250 MO$="insert":CLS6:GOSUB10:GO
SUB8:PRINT"enter line":LINEINPUT
C$:IFLEFT$(C$,1)=CHR$(94)THEN260
255 FORJ=IH TOI STEP-1:A=VARPTR(
A$(J)):B=VARPTR(A$(J+1)):FORK=0T
O4:POKEB+K,PEEK(A+K):NEXT:NEXT:I
=I+1:IH=IH+1:A$(I)=C$:IFCL<LEN(A
$(I))GOSUB300
```

In insert, the new text is obtained in line 250. In line 255, the variable table listing for each string is moved to the next higher array location. The text that was represented by, say, A$(10), the tenth line is now represented as A$(11). The program will then move the pointers for A$(9) up to the A$(10) location until the right line is opened up for the new text. Delete does the reverse, moving the variable table contents down and in the process erasing the address of the string being deleted. Though the deleted string still exists in memory, the computer has no way of finding it. Eventually a garbage collection will overwrite the deleted material and it will be gone for good.

All of the code for these routines are in the program listing at the end of this article. I invite you to study it. You may also want to rewrite these to use common subroutines in low line numbers to reduce the code in each section.

The printer code starting in line 600 is intended to print the text file for review and editing only. Hence, it is short without refinements. The baud rate setting routine is the fanciest thing there. Feel free to use it in your programs.

As more owners acquire disk drives, the ability to save or load using either tape or disk becomes more important. Tape makes a good long-term storage media for archive purposes and for sending data through the mail. The strategy used here is to have a saving and a loading routine. The variable D, for device number, is used with each *OPEN*, *PRINT#* and *LINE INPUT#* statement so these can apply to either disk or tape operations. For example, line 914 sets D =-1, gets the file name and runs past the tape leader if the user wishes. Control is then passed to 950 to *PRINT#-1* the data. But when disk is specified, line 911 sets D=1, gets the file name and transfers control to 950 that pre-forms the disk operation since D=1. Considerable flexibility and performance is achieved with a modest amount of code, much of which is in the menu to make the thing user friendly. Since the program listing follows closely, consult it for the 900 section coding.

This wraps up the discussion of *COMMWP*. It has served well as a discussion piece. There is much room for improvement and refinement and I hope that some of you do just that. If you do, keep in mind the modular concept that I have been teaching. There is plenty of room for more code in each block, except perhaps 200. You may also want to use the BASIC program framework, perhaps keeping the printer entry and tape/disk I/O and start over to do a different type of program. Once you have a library of program modules

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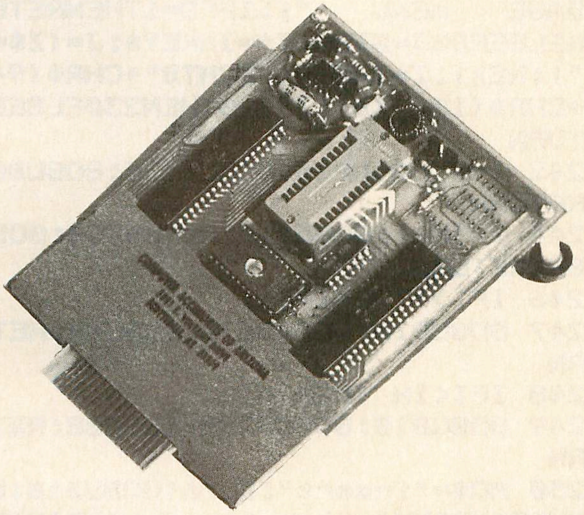

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like these, you can reuse them in other programs with minor modifications. Indeed, neither the I/O nor the printer routines were written for *COMMWP*.

210	0386
255	0629
310	0869
442	0AA5
542	0D26
640	101D
915	1260
1050	1514
END	1745

The listing:

```
0 GOTO11000
5 I=I-1
8 PRINT@96,STRING$(32,CHR$(163))
;:IFI>1THENPRINTA$(I-2)
9 PRINTA$(I-1):PRINTA$(I):RETURN
10 PRINT"LINE#"I" LINES"IH" ALLO
WED"LM,MO$" mode   ^<ENTER>=COMM
ANDS",,:RETURN
12 PRINT@32,"tOP  bOTTOM  UP/DOW
N ARROWS eDITiNSERT  dELETE  cOP
Y  mENU       ";:IFFG=1THENRETURN
ELSEFORJ=0TO0:Z$=INKEY$:J=(Z$=""
):NEXT:Z=INSTR("EIDCMTB"+CHR$(94
)+CHR$(10),Z$):IFZ=0THEN12ELSERE
TURN
14 I=1:GOSUB10:GOSUB12:GOSUB8:RE
TURN
16 I=IH+1:GOSUB10:GOSUB12:GOSUB8
:RETURN
18 IFI>1THENI=I-1
19 GOSUB10:GOSUB12:GOSUB8:RETURN
20 IFI<IH THENI=I+1
21 GOSUB10:GOSUB12:GOSUB8:RETURN
100 MO$=" enter":CLS4:I=IH+1:GOS
UB10:GOSUB8:LINEINPUTC$:IFLEFT$(
C$,1)<>CHR$(94)THENIFA$(I)=""THE
NA$(I)=A$(I)+C$:ELSEA$(I)=A$(I)+
" "+C$ELSE105
102 IH=I:IFLEN(A$(I))>CL GOSUB30
0:IFLEN(A$(I+1))>CL THENI=I+1:GO
TO102:ELSE100ELSE100
105 I=I-1
110 PRINT@480,"COMMAND ?";:GOSUB
12:ONZ GOTO200,250,400,500,1000:
Z=Z-5:CLS3:FG=1:ONZ GOSUB14,16,1
8,20:FG=0:GOTO110
200 MO$="  edit":CLS5:GOSUB10:GO
SUB8:LINEINPUT"old phrase  ";A$:
IFA$=""ORA$=CHR$(94)THEN220
210 F=INSTR(A$(I),A$):IFF=0THENC
LS5:GOSUB10:GOSUB8:PRINT"phrase
not found":LINEINPUT"old phrase
 ";A$:IFA$=""ORA$=CHR$(94)THEN22
0ELSE210
215 LINEINPUT"new phrase  ";B$:L
1=LEN(A$(I)):A=LEN(A$):C$=LEFT$(
A$(I),F-1):L2=LEN(C$):L3=L1-(A+L
2):Q$=RIGHT$(A$(I),L3):A$(I)=C$+
B$+Q$:GOTO200
220 PRINT@480,"command ?";:GOSUB
230:ONZ GOTO200,100,1000:Z=Z-3:C
LS5:FG=1:ONZ GOSUB242,244,246,24
8:FG=0:GOTO220
230 PRINT@32,"tOP  bOTTOM  UP/DO
WN ARROWS     eDIT   cURRENT MES
SAGE   mENU    ";:IFFG=1THENRETUR
NELSEFORJ=0TO0:Z$=INKEY$:J=(Z$="
"):NEXT:Z=INSTR("ECMTB"+CHR$(94)
+CHR$(10),Z$):IFZ=0THEN230ELSERE
TURN
242 I=1:GOSUB10:GOSUB230:GOSUB8:
RETURN
244 I=IH+1:GOSUB10:GOSUB230:GOSU
B8:RETURN
246 IFI>1THENI=I-1
247 GOSUB10:GOSUB230:GOSUB8:RETU
RN
248 IFI<IH THENI=I+1
249 GOSUB10:GOSUB230:GOSUB8:RETU
RN
250 MO$="insert":CLS6:GOSUB10:GO
SUB8:PRINT"enter line":LINEINPUT
C$:IFLEFT$(C$,1)=CHR$(94)THEN260
255 FORJ=IH TOI STEP-1:A=VARPTR(
A$(J)):B=VARPTR(A$(J+1)):FORK=0T
O4:POKEB+K,PEEK(A+K):NEXT:NEXT:I
=I+1:IH=IH+1:A$(I)=C$:IFCL<LEN(A
```

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```
$(I))GOSUB300
260 PRINT@480,"command ?";:GOSUB
270:ONZ GOTO250,100,1000:Z=Z-3:C
LS5:FG=1:ONZ GOSUB282,284,286,28
8:FG=0:GOTO260
270 PRINT@32,"tOP  bOTTOM  UP/DO
WN ARROWS       iNSERT   cURRENT M
ESSAGE   mENU ";:IFFG=1THENRETUR
NELSEFORJ=0TO0:Z$=INKEY$:J=(Z$="
"):NEXT:Z=INSTR("ICMTB"+CHR$(94)
+CHR$(10),Z$):IFZ=0THEN270ELSERE
TURN
282 I=1:GOSUB10:GOSUB270:GOSUB8:
RETURN
284 I=IH+1:GOSUB10:GOSUB270:GOSU
B8:RETURN
286 IFI>1THENI=I-1
287 GOSUB10:GOSUB270:GOSUB8:RETU
RN
288 IFI<IH THENI=I+1
289 GOSUB10:GOSUB270:GOSUB8:RETU
RN
300 FORJ=I TOIH:F1=0:IFLEN(A$(J)
)<CL THENNEXT:RETURN
305 F=INSTR(F1+1,A$(J)," "):IFF<
CL ANDF<>0THENF1=F:GOTO305ELSEC$
=RIGHT$(A$(J),LEN(A$(J))-F1):A$(
J)=LEFT$(A$(J),F1)
310 IFJ<IH ANDA$(J+1)<>""ANDLEFT
$(A$(J+1),1)<>" "THENA$(J+1)=C$+
" "+A$(J+1):NEXT:RETURN
315 IFJ=IH THENA$(J+1)=C$:RETURN
320 FORJ1=IH TOI STEP-1:A=VARPTR
(A$(J1)):B=VARPTR(A$(J1+1)):FORK
=0TO4:POKEB+K,PEEK(A+K):NEXT:NEX
T:IH=IH+1:A$(J1+1)=C$:NEXT
400 MO$="delete":CLS7:GOSUB10:GO
SUB8:PRINT"delete this line? Y/N
 ":FORJ=0TO0:C$=INKEY$:J=(C$=""
):NEXT:IFC$=CHR$(94)ORC$<>"Y"THE
N410405 FORJ=I TOIH-1:A=VARPTR(A
$(J+1)):B=VARPTR(A$(J)):FORK=0TO
4:POKEB+K,PEEK(A+K):NEXT:NEXT:I=
I-1:IH=IH-1
410 PRINT@480,"command ?";:GOSUB
420:ONZ GOTO400,100,1000:Z=Z-3:C
LS5:FG=1:ONZ GOSUB442,444,446,44
8:FG=0:GOTO410
420 PRINT@32,"tOP  bOTTOM  UP/DO
WN ARROWS       dELETE   cURRENT M
ESSAGE   mENU ";:IFFG=1THENRETUR
NELSEFORJ=0TO0:Z$=INKEY$:J=(Z$="
"):NEXT:Z=INSTR("DCMTB"+CHR$(94)
+CHR$(10),Z$):IFZ=0THEN420ELSERE
TURN
442 I=1:GOSUB10:GOSUB420:GOSUB8:
RETURN
444 I=IH+1:GOSUB10:GOSUB420:GOSU
B8:RETURN
446 IFI>1THENI=I-1
447 GOSUB10:GOSUB420:GOSUB8:RETU
RN
448 IFI<IH THENI=I+1
449 GOSUB10:GOSUB420:GOSUB8:RETU
RN
500 CLS8:GOSUB10:GOSUB540:GOSUB8
:PRINT"copy this line? Y?":FORJ=
0TO0:Z$=INKEY$:J=(Z$=""):NEXT:Z=
INSTR("YCMTB"+CHR$(94)+CHR$(10),
Z$):IFZ=0THEN500
505 ONZ GOTO510,100,1000:Z=Z-3:C
LS8:ONZ GOSUB542,544,546,548:GOT
O500
510 C$=A$(I)
515 CLS8:GOSUB10:GOSUB540:GOSUB8
:PRINT"insert...   "C$:PRINT"here
? Y?":FORJ=0TO0:Z$=INKEY$:J=(Z$=
""):NEXT:Z=INSTR("YCMTB"+CHR$(94
)+CHR$(10),Z$):IFZ=0THEN515
520 ONZ GOTO525,100,1000:Z=Z-3:C
LS8:ONZ GOSUB540,544,546,548:GOT
O515
525 FORJ=IH TOI STEP-1:A=VARPTR(
A$(J)):B=VARPTR(A$(J+1)):FORK=0T
O4:POKEB+K,PEEK(A+K):NEXT:NEXT:I
=I+1:IH=IH+1:A$(I)=C$:GOTO500
540 PRINT@32,"tOP  bOTTOM  UP/DO
WN ARROWS                cURRENT M
ESSAGE   mENU ";:RETURN
542 I=1:RETURN
```

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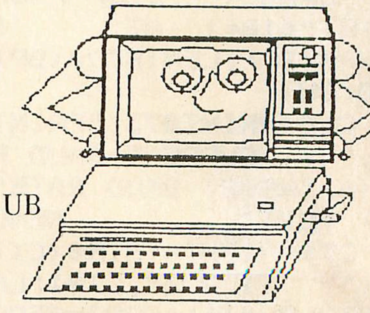

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```
544 I=IH+1:RETURN
546 IFI>1THENI=I-1
547 RETURN
548 IFI<IH THENI=I+1
549 RETURN
600 POKE65494,0:BP=PEEK(150):BU=
INSTR("61841  87        180",RIGHT
$(STR$(BP),LEN(STR$(BP))-1)):BU=
4800/BU
610 CLS:PRINT@73,"PRINT ROUTINES
",,,"     CURRENT BAUD RATE ="BU,
TAB(6)"RESET BAUD RATE",,,"     P
RINT TEXT",,,,"      MENU":CT=1
615 CT$=RIGHT$(STR$(CT),1):LP=IN
STR("    1 2 3",CT$):LP=LP*32+2:
PRINT@LP,">";:FORJ=0TO0:Z$=INKEY
$:J=(Z$=""):NEXT:PRINT@LP," ";
620 IFZ$=CHR$(10)ANDCT<3THENCT=C
T+1:GOTO615ELSEIFZ$=CHR$(94)ANDC
T>1THENCT=CT-1:GOTO615ELSEIFZ$<>
CHR$(13)THEN615ELSEON CT GOTO625
,640,1000
625 PRINT" ";:INPUT"ENTER NEW BA
UD RATE";BU$:BU$=LEFT$(BU$,1):BL
=INSTR("36124",BU$):IFBL=0THENPR
INT"baud rate error":SOUND100,50
:GOTO600
630 BU(1)=180:BU(2)=87:BU(3)=41:
BU(4)=18:BU(5)=6:POKE150,BU(BL):
GOTO600
640 CLS:PRINT@194,"SET TOP OF SH
EET AT PRINTER          HEAD AND PR
ESS ANY KEY":FORJ=0TO0:J=(INKEY$
=""):NEXT:LM=INT(80/CL):FORJ=1TO
5:PRINT#-2," "
650 FORI=1TOIH:PRINT#-2,TAB(LM)A
$(I):NEXT:GOTO1000
900 CLS3:PRINT@66,"  SAVE TO TAP
E  ";:PRINT@130,"  SAVE TO DISK
 ";:PRINT@194,"  LOAD FROM TAPE"
;:PRINT@258,"  LOAD FROM DISK";:
CT=1905 CT$=RIGHT$(STR$(CT),1):L
P=INSTR(" 1 2 3 4",CT$):LP=LP*32
+2:PRINT@LP,">";:FORJ=0TO0:Z$=IN
KEY$:J=(Z$=""):NEXT:PRINT@LP," "
;
910 IFZ$=CHR$(10)ANDCT<4THENCT=C
T+1:GOTO905ELSEIFZ$=CHR$(94)ANDC
T>1THENCT=CT-1:GOTO905ELSEIFZ$<>
CHR$(13)THEN905ELSEON CT GOTO914
,911,913,912
911 D=1:PRINT@322,"FILE NAME";:I
NPUTNA$:GOTO950
912 D=1:PRINT@322,"FILE NAME";:I
NPUTNA$:GOTO920
913 D=-1:PRINT@322,"FILE NAME";:
INPUTNA$:GOTO920
914 D=-1:PRINT@322,"FILE NAME";:
INPUTNA$:PRINT@386,"RUN PAST LEA
DER Y/N":INPUTI$:IFI$="Y"THENMOT
ORON:FORK=1TO6000:NEXT::GOTO950
915 GOTO950
```

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```
920 OPEN"I",D,NA$:I=0
925 IF EOF(D) THENCLOSED:IH=I:GO
TO1000
930 I=I+1:LINEINPUT#D,A$(I):GOTO
925
950 AUDIOON:OPEN"O",D,NA$:FORI=1
TOIH:PRINT#D,A$(I):NEXT:CLOSED:I
FCT>0AND D=-1THENMOTORON:FORK=1T
O600:NEXT:MOTOROFF:CT=0ELSE1000
1000 CLS3:PRINT@41,"COMMUNICATIO
NS";:PRINT@73,"WORD PROCESSOR";:
PRINT@105," VERSION  1.0 ";:PRIN
T@197,"nEW MESSAGE           ";:P
RINT@229,"cURRENT MESSAGE       "
;
1005 PRINT@261,"bULLETIN BOARD L
IMITS";:PRINT@293,"pRINT MESSAGE
      ";:PRINT@325,"sAVE/LOAD
MESSAGE      ";:FORJ=0TO0:Z$=INKEY
$:J=(Z$=""):NEXT:Z=INSTR("NCBPS"
,Z$):IFZ=0THEN1000
1010 ONZ GOTO1020,100,1050,600,9
00
1020 FORI=1TO50:A$(I)="":NEXT:I=
0:IH=0
1050 CLS3:PRINT@70,"BULLETIN BOA
RD LIMITS";:PRINT@166,"cHARACTER
S/LINE  "CL;:PRINT@198,"lINES/ME
SSAGE     "LM;:PRINT@230,"oK AS I
S                ";:FORJ=0TO0:Z$=IN
KEY$:J=(Z$=""):NEXT:Z=INSTR("CLO
",Z$):ONZ GOTO1060,1070,1080
1055 GOTO1050
1060 C$="":PRINT@184,"  ";:FORK=
0TO1:FORJ=0TO0:Z$=INKEY$:J=(Z$="
"):NEXT:PRINT@184+K,Z$;:C$=C$+Z$
:NEXT:CL=VAL(C$):GOTO1050
1070 C$="":PRINT@216,"  ";:FORK=
0TO1:FORJ=0TO0:Z$=INKEY$:J=(Z$="
"):NEXT:PRINT@216+K,Z$;:C$=C$+Z$
:NEXT:LM=VAL(C$):GOTO1050
1080 IFIH=0THEN100ELSEIFIH>LM TH
ENCLS3:PRINT@168,"CURRENT MESSAG
E";:PRINT@299," HAS MORE LINES "
;:PRINT@232,"THAN LIMIT SET.";:P
RINT@296," PRESS ANY KEY ";:PRIN
T@328," TO  CONTINUE ";:FORJ=0TO
0:J=(INKEY$=""):NEXT
1090 I=1:GOSUB300:GOTO100
2000 CLEAR5000:DIMA$(50)
2010 CL=64:LM=16:A=0:B=0:K=0
2100 GOTO1000
10000 AUDIOON:INPUT"RUN PAST LEA
DER Y/N";I$:IFI$="Y"THENMOTORON:
FORX=1TO6000:NEXT
10010 FORC=1TO2:CSAVE"COMMWP":MO
TORON:FORX=1TO600:NEXT:NEXT:MOTO
ROFF'END
11000 PCLEAR1:GOTO2000
```

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GAME

16K
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Doin' the Hi-Res Shuffle

Program
By
Phillip Beistel

***Shuffle** is one of three programs on **the Rainbow** 'Record.' See page 146.*

If you've ever shuffled little numbered plastic squares around on a palm-sized plastic board, trying to order them chronologically, you know the game called Shuffle. Whether in its solid form it was called that or something else, I'm unsure. Nevertheless, it was always enjoyable—an established item in that revolving crop of kid-crazes which included the yo-yo, Hula hoop and Gumbo shooter.

In its computerized form, the game gives up its pocket portability, but it gains in pizazz with some very nicely done hi-res graphics. Phillip Beistel's outstanding version of this classic, by the way, is not only listed here, but is also one of the three programs on our *Rainbow* "Record" which you will find on page 146.

Shuffle has a couple of quite interesting features: the most obvious is the flashing name at the top of the screen. The routine starting at line 46 does the flashing. Also, Phillip uses the keyboard rollover table to allow faster access of the keyboard. You'll find this within the line 46 routine, as well.

The game will randomly place 15 numbers inside a 4 x 4 matrix. The object is to rearrange the numbers into ascending order by using the arrow keys to move the blank square and, consequently, the numbers, around the screen. If you get frustrated, you can quit at any time by pressing the "Q" key. When the game is either finished, or you quit, the number of moves and the time used is displayed.

We think this is an excellent quality game, worthy of its inclusion in our first "record," and hope you will take advantage of this for easy loading. For those who prefer the direct approach, we give you the following listing.

(Mr. Beistel has been associated with large computer hardware and software for nearly 15 years and has been writing 80C software during the last three years.)

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11	01D3
26	0472
38	0727
50	0A77
70	0C1F
90	0F17
END	1044

The listing:

```
1 RUN6
2 ' SHUFFLE
3 ' by PHIL BEISTEL
4 '     1439 ARNOLD ST.
5 '     PGH, PA. 15220
6 IF PEEK(&HC000)=126 AND PEEK(&
HC001)=126 THEN POKE65495,0
8 XR=RND(-TIMER):GOTO109
9 CLS(RND(8)):PRINT@11,"'SHUFFLE
'";:PRINT@96," ARRANGE THE NUMBE
RS FROM 1 TO":PRINT" 15, UPPER L
EFT TO LOWER RIGHT.":PRINT" USE
THE ARROW KEYS TO MOVE."
10 PRINT@228,"DUPLICATE THIS PAT
TERN:";:PRINT@298," 1  2  3  4";
:PRINT@330," 5  6  7  8";:PRINT@
362," 9 10 11 12";:PRINT@394,"13
 14 15   ";
```

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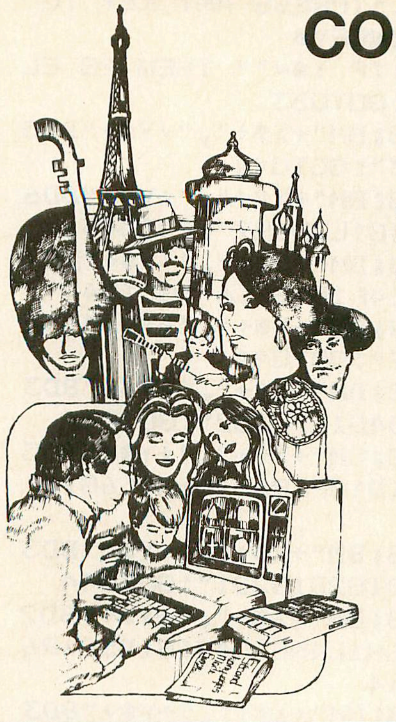

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```
11 DIM A(4,4),B(16):X16=0:Y16=0:
M=0:ZT=0
12 S$="T200L200O4V31;1;2;3;4;5;6
;7;8;9;10;11;12;11;10;9":T$="T10
0;L100V31;O4;1;12"
13 FORX=1TO4:FORY=1TO4:A(X,Y)=0:
NEXTY:NEXTX:SCREEN0,0:FORX=1TO16
:B(X)=X:NEXTX
14 FORX=1TO4:FORY=1TO4
15 D=RND(16)
16 IF B(D)=0 THEN 15
17 IF D=16 THEN X16=X:Y16=Y
18 A(X,Y)=B(D):B(D)=0:NEXTY,X
19 PMODE1,1:PCLS
20 DRAW"C2;S8;BM72,4;BD1D1F1R3F1
D2G1L3H1BU5E1R3F1BR4BU1;D7U4R5NU
3D4;BR4BU7D6F1R3E1U6BR4NR5D3NR4D
4BR5;BU7BR4NR5D3NR4D4BR5;BR4BU7D
7R5;BU7BR4NR5D3NR4D4R5"
21 DRAW"C3;S4;BM28,28;R203;D163;
L203;U163"
22 PAINT(40,30),2,3
23 DRAW"C3;S4;R51;D163;R51;U163;
R51;D163;R50;U40;L203;U41;R203;U
41;L203"
24 GOSUB52
25 FORX=1TO4:FORY=1TO4
26 PLAY T$:X$=STR$(((X-1)*50)+32
):Y$=STR$(((Y-1)*40)+32): ON A(X
,Y) GOTO 29,30,31,32,33,34,35,36
,37,38,39,40,41,42,43,44
27 PRINT@483,"(PRESS ANY KEY TO
PLAY.)";:I$=INKEY$
28 I$=INKEY$:IF I$="" THEN 28 EL
SE SCREEN1,0:GOTO53
29 DRAW"C4;S8;BM"+X$+","+Y$+"BD5
BR8E3D13NL3R3":GOTO44
30 DRAW"C4;S8;BM"+X$+","+Y$+"BD6
BR8U2E1R6F1D4G1L7D6R7":GOTO44
31 DRAW"C4;S8;BM"+X$+","+Y$+"BD2
BR6R6F1D4G1NL4F1D4G1L6":GOTO44
32 DRAW"C4;S8;BM"+X$+","+Y$+"BD2
BR12ND14G8R12":GOTO44
33 DRAW"C4;S8;BM"+X$+","+Y$+"BD3
BR6NR8D6R7F1D4G1L7H1U2":GOTO44
34 DRAW"C4;S8;BM"+X$+","+Y$+"BD3
BR7R6F1H1L6G1D10F1R6E1U6H1L6G1":
GOTO44
35 DRAW"C4;S8;BM"+X$+","+Y$+"BD3
BR6R10G2D1G2D1G2D1G2D1":GOTO44
36 DRAW"C4;S8;BM"+X$+","+Y$+"BD2
BR8R6F1D4G1L6H1U4NE1D4F1G1D5F1R6
E1U5H1":GOTO44
37 DRAW"C4;S8;BM"+X$+","+Y$+"BD3
BR8R6F1D4G1L6H1U4NE1D4F1R6G6":GO
TO44
38 DRAW"C4;S8;BM"+X$+","+Y$+"BD5
BR4E2D12NL2R2BR4R4E1U10H1L4G1D10
F1":GOTO44
39 DRAW"C4;S8;BM"+X$+","+Y$+"BD4
BR4E2D12NL2R2BR4R2NR2U12G2":GOTO
44
40 DRAW"C4;S8;BM"+X$+","+Y$+"BD5
BR4E2D12NL2R2BR4NR5U6R4U1R1U4L1U
1L3D1L1":GOTO44
41 DRAW"C4;S8;BM"+X$+","+Y$+"BD4
BR4E2D12NL2R2BR4R4E1U4H1NL3E1U4H
1L4":GOTO44
42 DRAW"C4;S8;BM"+X$+","+Y$+"BD4
BR4E2D12NR2L2BR12U12G6R8":GOTO44
43 DRAW"C4;S8;BM"+X$+","+Y$+"BD5
BR4E2D12NL2R2BR3BU1NU2F1R6E1U4H1
L6U6R7":GOTO44
44 IF M<>0 THEN RETURN ELSE NEXT
Y,X
45 GOTO27
46 DRAW"C2;S8;BM72,4;BD1D1F1R3F1
D2G1L3H1BU5E1R3F1BR4BU1;D7U4R5NU
3D4;BR4BU7D6F1R3E1U6BR4NR5D3NR4D
4BR5;BU7BR4NR5D3NR4D4BR5;BR4BU7D
7R5;BU7BR4NR5D3NR4D4R5"
47 IF PEEK(339)=251 OR PEEK(341)
=247 OR PEEK(342)=247 OR PEEK(34
3)=247 OR PEEK(344)=247 THEN 50
48 DRAW"C3;S8;BM72,4;BD1D1F1R3F1
D2G1L3H1BU5E1R3F1BR4BU1;D7U4R5NU
3D4;BR4BU7D6F1R3E1U6BR4NR5D3NR4D
4BR5;BU7BR4NR5D3NR4D4BR5;BR4BU7D
7R5;BU7BR4NR5D3NR4D4R5"
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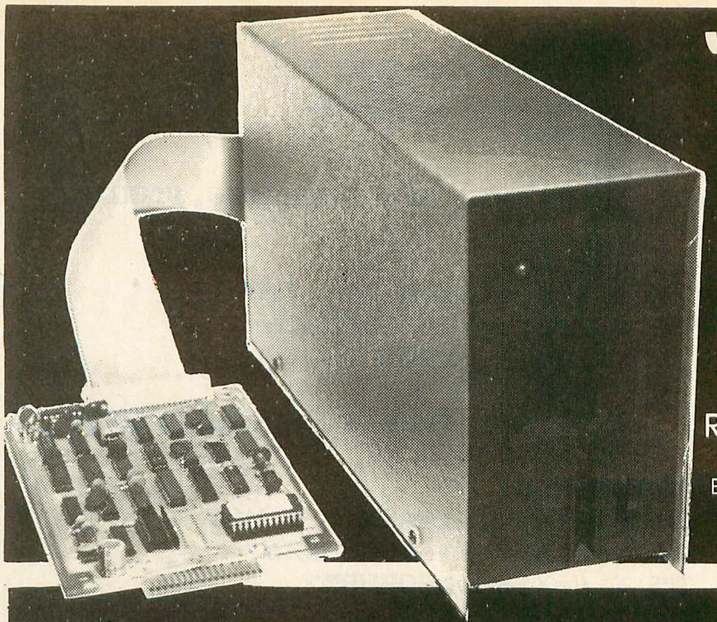

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```
49 IF PEEK(339)<>251 AND PEEK(34
1)<>247 AND PEEK(342)<>247 AND P
EEK(343)<>247 AND PEEK(344)<>247
 THEN 46
50 RETURN
51 PAINT(((X16-1)*50)+32,((Y16-1
)*40)+32),2,3:RETURN
52 PAINT(((X16-1)*50)+32,((Y16-1
)*40)+32),4,3:RETURN
53 TIMER=0
54 M=1:GOSUB46
55 IF PEEK(339)=251 THEN 108
56 ZT=ZT+1
57 IF PEEK(341)=247 THEN 62
58 IF PEEK(342)=247 THEN 75
59 IF PEEK(343)=247 THEN 68
60 IF PEEK(344)=247 THEN 81
61 GOTO54
62 IF Y16=4 THEN SOUND100,1:GOTO
54
63 GOSUB51
64 A(X16,Y16)=A(X16,Y16+1)
65 X=X16:Y=Y16:GOSUB26
66 Y16=Y16+1:GOSUB52
67 GOTO87
68 IF X16=4 THEN SOUND100,1:GOTO
54
69 GOSUB51
70 A(X16,Y16)=A(X16+1,Y16)
71 X=X16:Y=Y16:GOSUB26
72 X16=X16+1:GOSUB52
73 GOTO87
74 END
75 IF Y16=1 THEN SOUND100,1:GOTO
54
76 GOSUB51
77 A(X16,Y16)=A(X16,Y16-1)
78 X=X16:Y=Y16:GOSUB26
79 Y16=Y16-1:GOSUB52
80 GOTO87
81 IF X16=1 THEN SOUND100,1:GOTO
54
82 GOSUB51
83 A(X16,Y16)=A(X16-1,Y16)
84 X=X16:Y=Y16:GOSUB26
85 X16=X16-1:GOSUB52
86 GOTO87
87 IF A(1,1)=1 AND A(2,1)=2 AND
A(3,1)=3 AND A(4,1)=4 AND A(1,2)
=5 AND A(2,2)=6 AND A(3,2)=7 AND
 A(4,2)=8 AND A(1,3)=9 AND A(2,3
)=10 AND A(3,3)=11 AND A(4,3)=12
 AND A(1,4)=13 AND A(2,4)=14 AND
 A(3,4)=15 THEN 89
88 GOTO54
89 WN=TIMER:CLS(RND(8))
90 SC=1:FORQ=1TO10
91 SCREEN1,SC
92 PLAY S$
93 IF SC=1 THEN SC=0:GOTO95
94 SC=1
95 NEXT Q
96 PRINT@99," YOU COMPLETED THE
PUZZLE ";
97 PRINT@138," IN";ZT;"MOVES ";
98 SC=1
99 SQ=INT(WN/60):MQ=INT(SQ/60):S
Q=SQ-MQ*60
100 IF MQ=0 THEN 102
101 PRINT@170, MQ;"MIN. AND";SQ;
"SEC.";:GOTO103
102 PRINT@170, SQ;"SEC.";
103 PRINT@481,"PRESS Y TO TRY AG
AIN. N TO END";
104 I$=INKEY$:IF I$="" THEN 104
105 IF I$="Y" THEN M=0:CLS(RND(8
)):PRINT@200," RESTARTING ";:TIM
ER=0:ZT=0:GOTO12
106 IF I$<>"N" THEN104
107 CLS(RND(8)):PRINT@203,"T.T.F
.N.";:PRINT@448,"BYE-BYE";:POKE6
5494,0:NEW
108 CLS(RND(8)):PRINT@102," YOU
GAVE UP AFTER ";:PRINT@138,ZT;"M
OVES AND ";:WN=TIMER:GOTO98
109 PCLEAR2:GOTO9
```

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Stock Option Strategies For Experienced Traders

Stock options—Ah, visions of gleaming Rolls Royces, a seaside hideaway in the Caribbean, and me sipping rum drinks with bits of tropical fruit floating in them. All this and more drifted through my mind as I gazed at the *Stock Option Strategies* cassette in my hand.

Stock options offer the potential of immense gains for relative small investments, they also have a darker side—the possibility of sudden and complete loss of your investment.

The question was would this program and my trusty 80-C be able to guide me around the pitfalls of sudden loss and to a life of ease and plenty which I so justly deserve?

I'm sad to report that this review is being typed into my CoCo in the somewhat cluttered office of my home, instead of overlooking blue waters with a tanned companion at my side.

Advertising for the *Stock Option Strategies* program states that the program allows you to devise your own stock option strategies. Alas, the program did not allow me to do so. The problem lies more with the documentation than the program.

Program documentation only consists of a ¾ page xeroxed copy of typed instructions. Assumptions are made that the user is familiar with all the terminology of buying stock options, how they work and where to find the necessary information.

For instance, if you know what a strike price is, you're OK, if not, forget it, Charlie. The only hint as to where to find necessary information is a reference advising you to consult the Wall Street Journal.

A common mistake has been made by the author in asuming that the user has a working knowledge of the specific activities associated with the program. The program makes sense to the author, so it must be fine. Testing the program with end users ofter leads to adding needed additional explanations and instructions.

Documentation on a program of this type should include an explanation of how stock options are traded and a complete and concise set of definitions for all requested *INPUTS*.

Instructions on how to "test run" a few examples to familarize yourself with the programs operation should also be included so that the user can become comfortable with the program before taking a plunge with more than monopoly money. The single paragraph explanation of the mechanisms involved in stock option trading is just not enough.

The program itself does not offer the "bells and whistles" one expects from a professionally marketed, business-oriented program. The frills, like a colorful title page, are missing, but more important options, like saving your data and results to disk or tape for later retrieval, or printing your data on a printer, are also missing.

The program has a routine which graphs future stock prices in color and shows the resultant gains and losses.

Overall, the detail and presentation of *Stock Option Strategies* is not what I would expect from a tape available from a mailorder software marketer.

Greentree Software has missed regarding their target audience. In its existing form, it is most usable only by those now actively involved in stock option trading. I cannot recommend this program to those interested in learning about stock options before investing. As mentioned before, the problem lies more with incomplete documentation than the program itself.

Stock Option Strategies requires 16K.

(Greentree Software, P.O. Box 97, Greenwood, IN 46142, $14.95)

—Bruce Rothermel

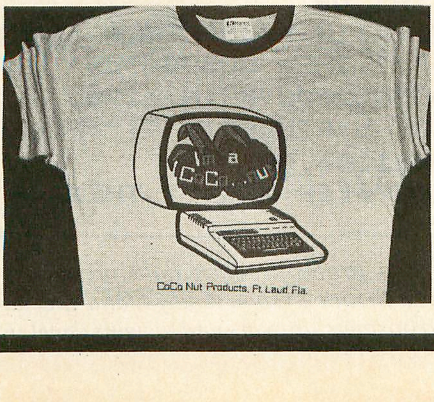
Hint . . .

Saving In ASCII

When you SAVE programs, CoCo can perform this function in two ways, by using binary codes or actual letters and numbers (called ASCII and pronounced AS-KEY).

Although it takes longer, ASCII sometimes is a more accurate way to SAVE a program, especially when you may be transferring programs between systems—say from a disk-based to a cassette-based system.

To SAVE in ASCII, simple add a comma and an "A" to the end of your SAVE instruction, like this: CSAVE "PROGRAM",A and the ASCII SAVE will be done by CoCo.



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Memory

Brain Strain With Schmaltz

By Jim Schmidt

Memory is several things at once. Obviously, it's a game. But it is also something of a memory trainer. Based on sound research, the concepts it uses are valid and real. It remains to be seen, however, if the memory improvement one seems to experience will last.

The use of simple ASCII character graphics along with sound, and care taken in the borders of the instructions give added interest, I hope, to the program.

All of us have purchased programs that perform quite well in their functions, but have such minor imperfections as misspelled words, words broken on the screen, vague instructions, and endless black text on green. It seems that having gotten the program to run properly, the programmer quits! Not much (if any) thought is given to packaging and eye appeal.

Memory is perhaps the other extreme. I normally would not load up such a simple game with as much gingerbread. It was done primarily to illustrate some of the things that can be done quite easily.

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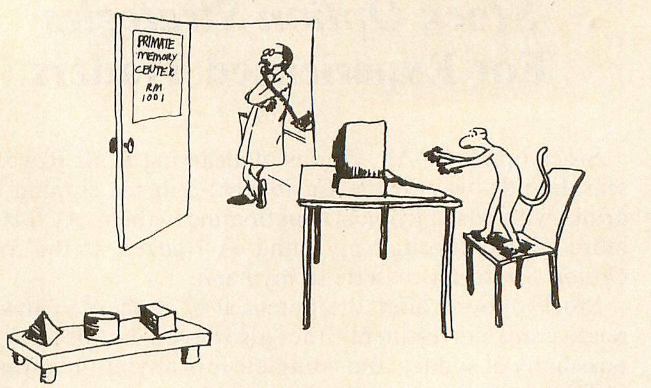

Regardless of what program you're working on, I don't think it ever hurts to throw in a little schmaltz!

***Memory** is one of three programs on **the Rainbow** 'Record.' See page 146.*

For those with 16K machines, a *PCLEAR 1* will be needed prior to *CLOADing* to provide enough free memory to load the program.

30	0049	1440	13D3
150	01CB	1620	16B5
480	05A6	1770	1922
760	08D4	2040	1C8D
920	0B98	3055	1FEE
1100	0E71	11500	22A9
1260	111B	END	25F3

The listing:

```
10 ' THE MEMORY BUILDER
20 ' A LEARNING GAME BY
30 ' JIM SCHMIDT
40 ' 196A ARLENE CT.
50 ' WHEELING, IL.
60 ' 60090
62 CLS0
63 POKE280,PEEK(275)
64 CLEAR1000
65 GOSUB10000
67 GOTO30000
70 GOSUB 1980
80 ' ENTRY FOR RERUN
90 CLS0
100 GOSUB2200:PRINT@128, "    WAN
T INSTRUCTIONS? - <Y/N)":POKE115
2,DB:POKE1183,DB
110 A$=INKEY$:IF A$="" THEN 110
120 IF A$="Y" THEN GOSUB 750
130 CLS0:GOSUB2200:PRINT@128,"
   NUMBER OF STRINGS (1-9)":POKE
1152,DB:POKE1183,DB
140 AI$=INKEY$:IF AI$="" THEN140
```

(Mr. Schmidt is a professional in data processing. Currently, he is a Senior System Analyst and specializes in financial/business software and systems development.)

CoCo Warehouse

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The best doesn't always cost more and MASTER CONTROL is a good example. What would you be willing to pay for a program that would cut your typing time by more than 50% and eliminate hours of debugging because you misspelled a command word? For example the command STRINGS (requires nine strokes, with MASTER CONTROL II you only require two strokes. Just hit the down arrow key twice and it's done, and no mistakes. That is just one of the 50 pre-programmed commands available to you. If that isn't enough you also have the ability to customize your own key to enter a statement or command, correctly, automatically every time. But thats not all, how about automatic line numbering. Just enter the starting number and the increment you want and MASTER CONTROL II will do it for you. You also have direct control of MOTOR, AUDIO and TRACE plus a direct RUN key. Sounds great? Well thousand of color computer owners have been enjoying these features for years. But now the new MASTER CONTROL II also has the following features:

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---

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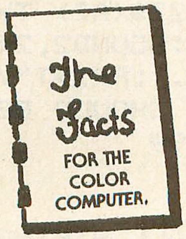

A MUST BOOK for the Color computer owner!

Schematics

Spec Sheets

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The first document to provide information that will allow the user to take advantage of all the features of the Color Computer. Aimed at the machine language user.

The FACTS attempts to explain, and describes in detail, how the user can make use of the computers internal features. Divided into two sections: Hardware and software; the primary emphasis is on hardware capabilities and circuits. Provides detailed explanations of all the internal large scale integrated circuits.

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By Spectral Associates

Magic Box is a special purpose utility designed to load TRS-80 Model I and III 50 Baud Basic programs into the Color Computer. Makes available a wide selection of software. Magic Box DOES NOT convert Machine language programs. Requires 16K Extended BASIC.

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You must hustle your lady bug through an intricate maze of barriers and turnstiles, while trying to earn points by eating all the dots, letters and hearts. Enemy bugs buzz after you and you must avoid the skulls! Exquisite sound adds to the excitement. A must game for anyone who enjoys fun and a challenge.

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```
150 SOUND234,1:A=VAL(AI$)
160 IF A=0 THEN PRINT"
CAN'T BE ZERO":SOUND7,7:FOR LO=1
 TO 100:NEXT:GOTO 130
165 IFA>5THENPRINT"
170 CLS0:GOSUB2200:PRINT@128,"
  LENGTH OF STRINGS <1-9> ":POK
E1152,DB:POKE1183,DB
180 BI$=INKEY$:IFBI$="" THEN 180
190 SOUND234,1:B=VAL(BI$)
200 IF B=0 THEN PRINT"
CAN'T BE ZERO":SOUND7,7:FOR LO=1
 TO 100:NEXT:GOTO 170
210 CLS0:GOSUB2200:PRINT@128,"
DIFFICULTY LEVEL <TIME><1-5>":PO
KE1152,DB:POKE1183,DB
220 CI$=INKEY$:IF CI$="" THEN 22
0
230 SOUND234,1:C=VAL(CI$)
240 IF C=0 THEN PRINT"
CAN'T BE ZERO":SOUND7,7:FOR LO=1
 TO 100:NEXT:GOTO 210
242 IF C>5 THEN PRINT"        YOU
MUST BE KIDDING!!!":SOUND7,7:FOR
 LO=1TO100:NEXT:GOTO210
250 C=900/C
260 GOSUB 330
270 CLS0
280 PRINT@32,"   PRESS SPACE BAR
 WHEN READY"
290 PRINT@140,"ready ??"
292 PRINT@148,STRING$(11,CHR$(14
4)):POKE1183,144:POKE1169,144
300 GOSUB2200
310 A$=INKEY$:IF A$="" THEN 310
320 GOTO 490
330 NO$="Y":GOSUB9000:DIM AA$(A)
:DIM ZZ$(A)
340 DATA A,B,C,D,E,F,G,H,I,J,K,L
,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z
350 FOR I=1TOA
360 FOR K=1TOB
370 D=RND(26)
380 FOR J=1TOD
390 READ BB$
400 NEXT
410 RESTORE
420 AA$(I)=AA$(I)+BB$
430 PRINT@128-32,"PLEASE WAIT...
"
440 SOUND234,1
450 PRINT@128,"I'M GETTING MY ST
UFF TOGETHER."
460 NEXT:NEXT
470 RETURN
480 CLS
490 FOR L=1TOA
493 PRINT@224,">>>>>>>>>>"
500 PRINT@235,AA$(L)
503 PRINT@246,"<<<<<<<<<<"
510 FOR M=1TOC:NEXT
515 SOUND245,1
516 PRINT@225,STRING$(30,255)
520 NEXT
530 SOUND 200,1:SOUND200,1
540 CLS0:PRINT"          ANSWER TI
ME !!!!"
550 PRINT "ENTER STRINGS ONE AT
A TIME AND <ENTER> AFTER EACH"
560 FORAZ=1TOA
570 INPUTZZ$(AZ)
580 IF AA$(AZ)><ZZ$(AZ) THENGOSU
B9000:SOUND134,7:SOUND2,24:PRINT
"YOU MISSED IT...":PRINT"YOU ENT
ERED ";ZZ$(AZ);" SHOULD BE "AA$(
AZ):R=R+1:GOTO 690
590 NEXT
600 GOSUB 9000
610 PRINT@96,"  ALL STRINGS ARE
CORRECT !!!!!"
620 SOUND 69,2:SOUND 111,9
630 SOUND 69,2:SOUND 111,9
640 SC=(A*2)+(B*3)+(VAL(CI$)*4)*
10
650 PRINT@160,"YOUR SCORE IS ";S
C
660 PRINT""
```

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SYSTEMS SOFTWARE

MACRO-80C

This is a **disk-based editor, macro assembler and monitor,** written for Color Computer by Andy Phelps. THIS IS IT — The ultimate programming tool!

The powerful 2-pass macro assembler features conditional assembly, local labels, include files and cross referenced symbol tables. MACRO-80C supports the complete Motorola 6809 instruction set in standard source format. There are no changes, constraints or shortcuts in the source language definition. Incorporating all of the features of our Rompack-based assembler (SDS80C), MACRO-80C contains many more useful instructions and pseudo-ops which aid the programmer and add power and flexibility.

The screen-oriented text editor is designed for efficient and easy editing of assembly language programs. The "Help Key" feature makes it simple and fun to learn to use the editor. As the editor requires no line numbers, you can use the arrow keys to position the cursor anywhere in the file. MACRO-80C allows global changes and moving/copying blocks of text. You can edit lines of assembly source which are longer than 32 characters.

DCBUG is a machine language monitor which allows examining and altering of memory, setting break points, etc.

The editor, assembler and monitor — as well as sample programs — come on one Radio Shack compatible disk. Extensive documentation included. **MACRO-80C Price: $99.95**

SOFTWARE DEVELOPMENT SYSTEM

The Micro Works Software Development System (SDS80C) is a complete 6809 editor, assembler and monitor package contained in one Color Computer program pack! Vastly superior to RAM-based assemblers/editors, the SDS80C is non-volatile, meaning that if your application program bombs, it can't destroy your editor/assembler. Plus it leaves almost all of 16K or 32K RAM free for **your** program. Since all three programs, editor, assembler and monitor are co-resident, we eliminate tedious program loading when going back and forth from editing to assembly and debugging!

The powerful screen-oriented Editor features finds, changes, moves, copys and much more. All keys have convenient auto repeat (typamatic), and since no line numbers are required, the full width of the screen may be used to generate well commented code.

The Assembler features **all** of the following: complete 6809 instruction set; conditional assembly; local labels; assembly to cassette tape or to memory; listing to screen or printer; and mnemonic error codes instead of numbers.

The versatile monitor is tailored for debugging programs generated by the Assembler and Editor. It features examine/change of memory or registers, cassette load and save, breakpoints and more. **SDS80C Price: $89.95**

MICRO WORKS COLOR FORTH

- Forth is faster to program in than Basic
  - Forth is easier to learn than Assembly Language
    - Forth executes in less time than Basic

Forth is a highly interactive language like Basic, with structure like Pascal and execution speed close to that of Assembly Language. The Micro Works Color Forth is a Rompack containing everything you need to run Forth on your Color Computer.

Color Forth consists of the standard FORTH Interest Group (FIG) implementation of the language plus most of FORTH-79. It has a super screen editor with split screen display. Mass storage is on cassette. Color Forth also contains a decompiler and other aids for learning the inner workings of this fascinating language. It will run on 4K, 16K, and 32K computers. Color Forth contains 10K of ROM, leaving *your* RAM for *your* programs! There are simple words to effectively use the Hi-Res Color Computer graphics, joysticks, and sound. The 112-page manual includes a glossary of the system-specific words, a full standard FIG glossary and complete source listing. COLOR FORTH . . . THE BEST! From the leader in Forth, Talbot Microsystems. **Price: $109.95**

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- — Talking to a timeshare system or information service
- — Printing out what is received as it is received
- — Saving received text to cassette tape
- — Re-displaying the received text even while on-line
- — Communications with other computers
- — Using your computer as a general-purpose 300-baud terminal
- — Downloading programs from other computers

The Microtext module is a program pack containing not only firmware but a second serial port so that both your printer and modem can be connected at the same time. Microtext can be configured for any serial printer that will work with the Color Computer, even if it requires line feeds! But even if you don't have a printer, you can keep a permanent copy of your data by storing to cassette tape. Also, any Radio Shack/Centronics-compatible parallel printer may be used by adding the Micro Works' PI80C parallel interface.

For those of you with special terminal applications, Microtext has selectable parity; it sends odd, even, mark or space. With mark parity (which is default) you can send to computers requiring either seven or eight bits. All 128 ASCII codes can be sent. Exchange programs with other Color Computer users! Basic programs may be downloaded from other computers or timesharing systems.

You'll find many uses for this versatile module! Available in ROMPACK, ready-to-use, for **$59.95.**

MACHINE LANGUAGE

MONITOR TAPE: A cassette tape which allows you to directly access memory, I/O and registers with a formatted hex display. Great for machine language programming, debugging and learning. It can also send/receive RS232 at up to 9600 baud, including host system download/upload. 19 commands in all. Relocatable and reentrant. **CBUG Tape Price: $29.95**

MONITOR ROM: The same program as above, supplied in 2716 EPROM. This allows you to use the entire RAM space. And you don't need to re-load the monitor each time you use it. The EPROM plugs into the Extended Basic ROM Socket or the Romless Pak I. **CBUG ROM Price: $39.95**

SOURCE GENERATOR: This package is a disassembler which runs on the color computer and generates your own source listing of the BASIC interpreter ROM. Also included is a documentation package which gives useful ROM entry points, complete memory map, I/O hardware details and more. A 16K system is required for the use of this cassette. **80C Disassembler Price: $49.95**

BOOKS

6809 Assembly Language Programming, by Lance Leventhal, **$16.95**

TRS-80 Color Computer Graphics, by Don Inman, **$14.95**

Assembly Language Graphics for the TRS-80 Color Computer, by Don Inman, **$14.95**

Starting Forth, by L. Brodie, **$19.95**

GAMES

Star Blaster — Blast your way through an asteroid field in this action-packed Hi-Res graphics game. Available in ROMPACK; requires 16K. **Price: $39.95**

Pac Attack — Try your hand at this challenging game by Computerware, with fantastic graphics, sound and action! Cassette requires 16K. **Price: $24.95**

Haywire — Have fun zapping robots with this Hi-Res game by Mark Data Products. Cassette requires 16K. **$24.95**

Dunkey Munkey — Arcade excitement awaits those who dare to conquer the Munkey! Joystick and 32K required, by Intellectronics. Cassette: **$24.95**

Colorpede — Great graphics, two-player option, and pause control in this exciting game by Intracolor Communication. Cassette requires 16K: **$29.95**

Adventure — *Black Sanctum* and *Calixto Island* by Mark Data Products. Each cassette requires 16K: **$19.95** each.

Cave Hunter — Experience vivid colors, bizarre sounds and eerie creatures in hot pursuit as you wind your way through a cave maze in search of gold treasures. This exciting Hi-Res game by Mark Data Products requires 16K for cassette version. **$24.95**

Starfire — Fly around the planet defending Earthlings from being snatched up by aliens in this challenging game from Intellectronics. Cassette requires 16K: **$21.95**

Doodle Bug — Joystick-controlled Doodle Bugs must move quickly through mazes while being chased by enemy bugs in Hi-Res game by Computerware. Cassette requires 16K: **$24.95**

Astro Blast — You'll need to act fast as you protect Earth from wave after wave of alien invaders in this Hi-Res game by Mark Data. Cassette requires 16K: **$24.95**

HARDWARE

PARALLEL PRINTER INTERFACE — Serial to parallel converter allows use of all standard parallel printers. PI80C plugs into the serial output port, leaving your Rompack slot free. You supply the printer cable. **PI80C Price: $69.95**

MEMORY UPGRADE KITS: Consisting of 4116 200ns., integrated circuits, with instructions for installation. **4K-16K Kit Price: $39.95. 16K-32K Kit** (requires soldering experience) **Price: $39.95.** For Rev. level E, ET, NC and TDP-100s, we carry 64K chips; upgrading is easy! Eight prime **64K chips** and instructions: **$64.95**

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```
670 PRINT@224,"C O N G R A T U L
 A T I O N S ! "
680 GOTO 710
690 PRINT"":PRINT"PROGRESS IS...
 CONTINUOUSLY       TRYING."
700 PRINT"DEFEAT IS... NOT TRYIN
G."
710 PRINT""
720 PRINT"AGAIN? <Y/N>"
730 S$=INKEY$:IF S$="" THEN 730
740 IF S$="Y" THEN RUN 80  ELSE
GOTO 15000
745 END
750 '
760 CLS:CG=1:GOTO2200
765 PRINT"             ***MEMORY***"
766 GOSUB 8000
770 PRINT"          IT HAS BEEN KNO
WN"
775 GOSUB 8010
780 PRINT"        FOR SOME TIME THA
T"
785 GOSUB 8020
790 PRINT"        WHAT WE CALL MEMO
RY"
795 GOSUB 8030
800 PRINT"        IS REALLY TWO VER
Y"
805 GOSUB 8040
810 PRINT"        DIFFERENT FUNCTIO
NS."
815 GOSUB 8050
820 PRINT"        CALLED SHORT TERM
 AND"
825 GOSUB 8060
830 PRINT"        LONG TERM MEMORY,
 THESE"
835 GOSUB 8070
840 PRINT"        TWO ABILITIES CAN
 NOT"
845 GOSUB 8080
850 PRINT"        ONLY BE TRAINED,
BUT "
855 GOSUB 8090
860 PRINT"        CAN ACTUALLY BE M
ADE TO"
865 GOSUB 8100
870 PRINT"        ACHIEVE SOME VERY
"
875 GOSUB 8110
880 PRINT"        REMARKABLE RESULT
S IF"
885 GOSUB 8120
890 PRINT"        YOU ARE WILLING T
O TRY."
895 GOSUB 8130
900 PRINT"               <ANY KEY>"
905 GOSUB 8140
915 GOSUB 8150
920 GL$=INKEY$:IF GL$="" THEN 92
0
930 CLS:PRINT"":CG=2:GOTO2200
940 PRINT"          IT IS NOT A MA
TTER "
945 GOSUB 8000
950 PRINT"        OF INTELLIGENCE.
 WE "
955 GOSUB 8010
960 PRINT"        ALL HAVE THE NECE
SSARY"
965 GOSUB 8020
970 PRINT"        EQUIPMENT.  IT IS
"
975 GOSUB 8030
980 PRINT"        MOSTLY A MATTER O
F "
985 GOSUB 8040
990 PRINT"        EFFORT AND TRAINI
NG."
995 GOSUB 8050
1000 PRINT"       HOW MUCH EFFORT
IS,"
1005 GOSUB 8060
1010 PRINT"       OF COURSE, UP TO
 YOU."
1015 GOSUB 8070
1020 PRINT"       THE MORE YOU TRY
 THE "
1025 GOSUB 8080
1030 PRINT"       BETTER YOUR MEMO
RY WILL "
```

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```
1035 GOSUB 8090
1040 PRINT"     GET.  YOUR SHORT
 TERM"
1045 GOSUB 8100
1050 PRINT"     MEMORY IS THE ON
E THAT"
1055 GOSUB 8110
1060 PRINT"     CAN MOST BE IMPR
OVED."
1065 GOSUB 8120
1070 PRINT"            <ANY KEY>"
1075 GOSUB 8130
1077 GOSUB 8140
1080 GOSUB 8150
1090 GL$=INKEY$:IFGL$="" THEN 10
90
1100 CLS:PRINT"":CG=3:GOTO2200
1110 PRINT"       BY UTILIZING
ONE "
1115 GOSUB 8000
1120 PRINT"     OF THE FAVORITE
TRAINING"
1125 GOSUB 8010
1130 PRINT"     METHODS USED BY
THE"
1135 GOSUB 8020
1140 PRINT"     RESEARCHERS IN T
HIS "
1145 GOSUB 8030
1150 PRINT"     FIELD, THE TIMED
"
1155 GOSUB 8040
1160 PRINT"     SEQUENCE/RANDOM
GROUP"
1165 GOSUB 8050
1170 PRINT"     LETTERS METHOD,
YOU"
1175 GOSUB 8060
1180 PRINT"     CAN POTENTIALLY
IMPROVE"
1185 GOSUB 8070
1190 PRINT"     YOUR MEMORY AS F
AR AS"
1195 GOSUB 8080
1200 PRINT"     YOU ARE WILLING
TO GO."
1205 GOSUB 8090
1210 PRINT"     AND, YOU CAN HAV
E SOME"
1215 GOSUB 8100
1220 PRINT"     FUN DOING IT WHI
LE YOU"
1225 GOSUB 8110
1230 PRINT"     CHART YOUR PROGR
ESS.
1235 GOSUB 8120
1240 PRINT"            <ANY KEY>"
1245 GOSUB 8130
1246 GOSUB 8140
1250 GOSUB 8150
1260 GL$=INKEY$:IFGL$="" THEN 12
60
1270 CLS:PRINT"":CG=4:GOTO2200
1280 PRINT"         THIS PROGRAM
WILL"
1285 GOSUB8000
1290 PRINT"     PROVIDE YOU WITH
"
1295 GOSUB8010
1300 PRINT"     VARYING LENGTH S
TRINGS"
1305 GOSUB8020
1310 PRINT"     OF RANDOM LETTER
S AT"
1315 GOSUB8030
1320 PRINT"     VARYING SPEEDS.
 YOU"
1325 GOSUB8040
1330 PRINT"     CONTROL THE LENG
TH AND"
1335 GOSUB8050
1340 PRINT"     SPEED.  YOU ALSO
 CAN"
1345 GOSUB8060
1350 PRINT"     SELECT THE NUMBE
R OF"
1355 GOSUB8070
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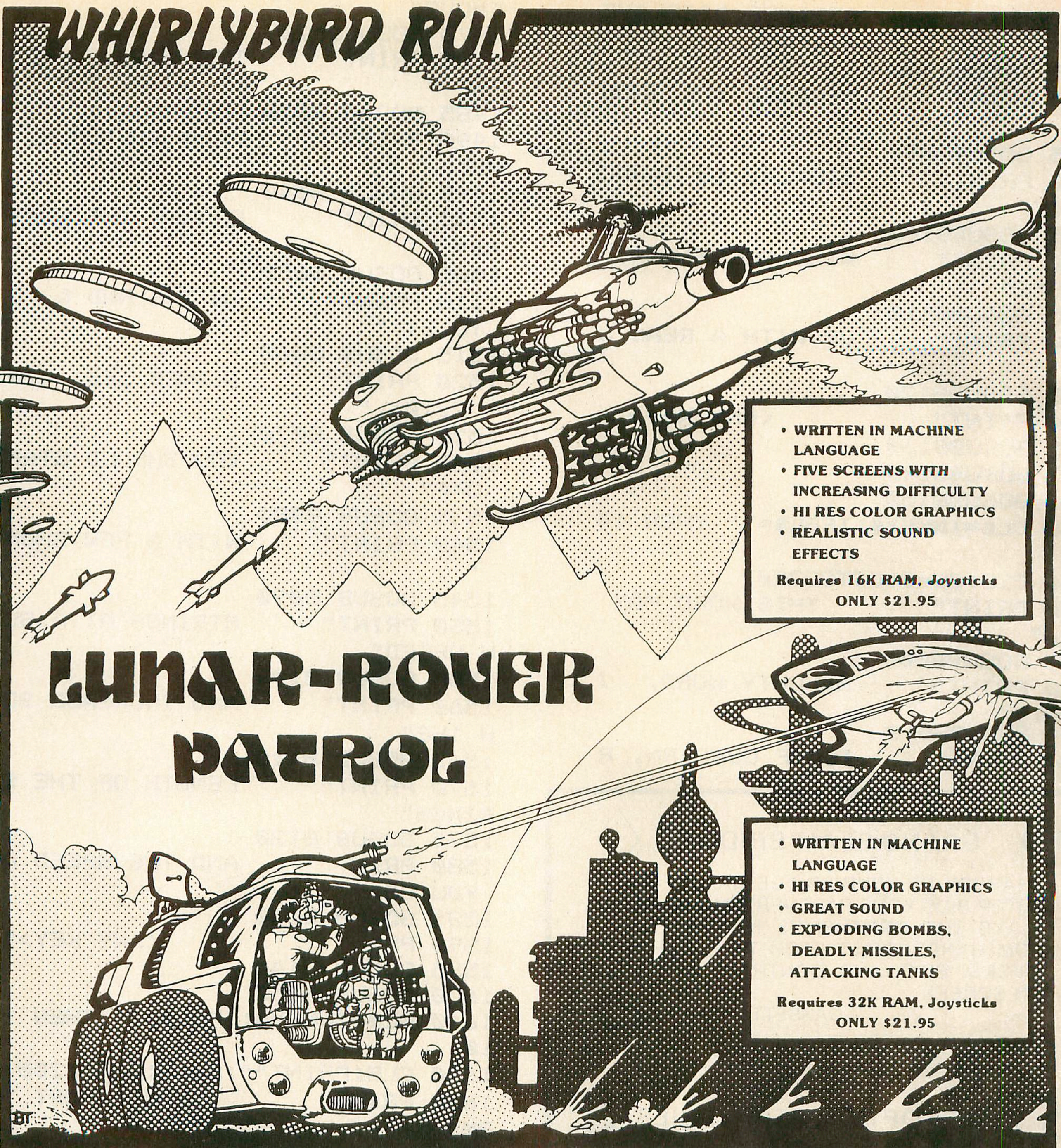

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```
1360 PRINT"        STRINGS DISPLAYE
D."
1365 GOSUB8080
1370 PRINT"        BECAUSE THE GROU
P"
1375 GOSUB8090
1380 PRINT"        DISPLAY IS RANDO
M, IT"
1385 GOSUB8100
1390 PRINT"        WILL OCCASIONALL
Y COME"
1395 GOSUB8110
1400 PRINT"        UP WITH A REAL W
ORD."
1405 GOSUB8120
1410 PRINT"               <ANY KEY>"
1415 GOSUB8130
1417 GOSUB8140
1420 GOSUB8150
1430 GL$=INKEY$:IFGL$="" THEN 14
30
1440 CLS:CG=5:GOTO2200
1450 PRINT"          THIS WORD MAY
BE A"
1455 GOSUB8000
1460 PRINT"        NAUGHTY WORD.  I
F THIS"
1464 GOSUB8010
1470 PRINT"        IS OF CONCERN, R
EMOVE"
1475 GOSUB8020
1480 PRINT"        THE VOWELS FROM
THE "
1485 GOSUB 8030
1490 PRINT"        DATA STATEMENT A
ND"
1495 GOSUB 8040
1500 PRINT"        CHANGE THE NUMBE
RS"
1505 GOSUB 8050
1510 PRINT"        IN THE RND & FOR
 TO 21."
1515 GOSUB 8060
1520 PRINT"        (LINES 340, 370
& 2210)."
1525 GOSUB 8070
1530 PRINT"        YOU SHOULD START
 OFF"
1535 GOSUB 8080
1540 PRINT"        WITH A FEW SHORT
"
1545 GOSUB 8090
1550 PRINT"        STRINGS AT A SLO
W SPEED"
1555 GOSUB 8100
1560 PRINT"        AND INCREASE BOT
H THE"
1565 GOSUB 8110
1570 PRINT"        LENGTH OF THE ST
RINGS"
1575 GOSUB 8120
1580 PRINT"        AND THE SPEED AS
 YOU GO."
1585 GOSUB 8130
1590 PRINT"               <ANY KEY>"
1595 GOSUB 8140
1600 GOSUB 8150
1610 GL$=INKEY$:IFGL$="" THEN 16
10
1620 CLS:PRINT"":CG=6:GOTO2200
1630 PRINT"          YOUR SHORT TE
RM"
1635 GOSUB8000
1640 PRINT"        MEMORY, AS AN AV
ERAGE,"
1645 GOSUB8010
1650 PRINT"        CAN HANDLE 7 ITE
MS."
1655 GOSUB8020
1660 PRINT"        BY USING 'GROUPS
'"
1665 GOSUB8030
1670 PRINT"        (STRINGS) OF LET
TERS"
1675 GOSUB8040
1680 PRINT"        YOU CAN REMEMBER
 LONGER"
1685 GOSUB8050
1690 PRINT"        SEQUENCES.  THIS
```

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VDOS lets you use the "extra" memory inside your CoCo as a virtual disk, with programs (any programs) stored out of the way. You can "save" and "load" programs from your in-memory disk into working memory, and then run them. When you're done, you can simply access your in-memory disk again . . . and save or load another, and another.

And VDOS is fast. Because you are using memory rather than a mechanical device (like a disk drive or cassette player), programs load instantly. Yes, VDOS is faster than a disk!

VDOS works with all Color Computers—from 16K non-extended to 64K extended. Obviously, the more memory you have, the greater number (and length) of programs you can store. For a 64K system, VDOS also uses the "unused" part of memory, providing up to 50,000 bytes of storage! Now, that's some disk!

We call it VDOS because in the future there will be utilities for your VDOS UNDISK that will give even greater capabilities—such as a full one-pass memory dump to cassette. Other utilities are planned, too.

We believe VDOS is the greatest advancement for CoCo since the introduction of the disk drive itself. And, at less than $100, it is so inexpensive you can't afford to be without it. If you have the "cassette blues," VDOS *is* the answer!

Finally, VDOS is simple to operate. It is entirely self-prompting and comes with a complete manual. But you almost don't even need the instructions—it requires absolutely no technical expertise.

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```
 IS"
1695 GOSUB8060
1700 PRINT"      BECAUSE, WITH PR
ACTICE,"
1705 GOSUB8070
1710 PRINT"      YOUR MEMORY USES
 THE "
1715 GOSUB8080
1720 PRINT"      SAME 'SLOT' FOR
A "
1725 GOSUB8090
1730 PRINT"      WHOLE GROUP AS F
OR A "
1735 GOSUB8100
1740 PRINT"      SINGLE LETTER."
1745 GOSUB 8110
1750 PRINT"            <ANY KEY>"
1752 GOSUB8120
1755 GOSUB8130
1757 GOSUB8140
1760 GOSUB8150
1770 GL$=INKEY$:IFGL$="" THEN 17
70
1780 CLS:PRINT"":CG=7:GOTO2200
1790 PRINT"        SO IT IS NOT A
T ALL"
1795 GOSUB8000
1800 PRINT"      IMPOSSIBLE TO EX
PAND"
1805 GOSUB8010
1810 PRINT"      YOUR ABILITY TO
"
1815 GOSUB8020
1820 PRINT"      REMEMBER 7 LETTE
RS TO"
1825 GOSUB8030
1830 PRINT"      THE ABILITY TO R
EMEMBER"
1835 GOSUB8040
1840 PRINT"      7 GROUPS OF SAY
5 "
1845 GOSUB8050
1850 PRINT"      LETTERS.  YOU AR
E THEN"
1855 GOSUB8060
1860 PRINT"      REMEMBERING 35 L
ETTERS"
1870 PRINT"      WITH THE SAME ME
NTAL"
1880 PRINT"      HORSEPOWER USED
FOR 7."
1890 PRINT"      "
1895 GOSUB8070
1900 PRINT"         HOW FAR CAN Y
OU GO ?"
1905 GOSUB8080
1910 PRINT"      IF YOU ARE READY
 TO TRY"
1915 GOSUB8090
1920 PRINT"      GIVE ME A 'Y'"
1925 GOSUB8100
1926 GOSUB8110
1927 GOSUB8120
1928 GOSUB8130
1929 GOSUB8140
1930 GOSUB8150
1940 Q$=INKEY$:IF Q$="" THEN 194
0
1950 IF Q$="Y" THEN RETURN
1960 NO$="Y":GOSUB9000:PRINT@128
,"WELL, LET'S GET TOGETHER SOON.
.."
1970 END
1980 MM$="M E M O R Y"
1990 LC=491
2000 FOR JZ=1TO100
2010 PRINT@LC-11,"              ";M
M$
2020 LC=LC-32
2030 IF LC<32 THEN LC=491
2040 NEXT
2050 PRINT"           M  E  M  O
R  Y"
2060 PRINT"         M   E   M   O
  R   Y"
2070 PRINT"       M    E    M    O
  R    Y"
2075 PRINT" M     E     M     O
   R     Y"
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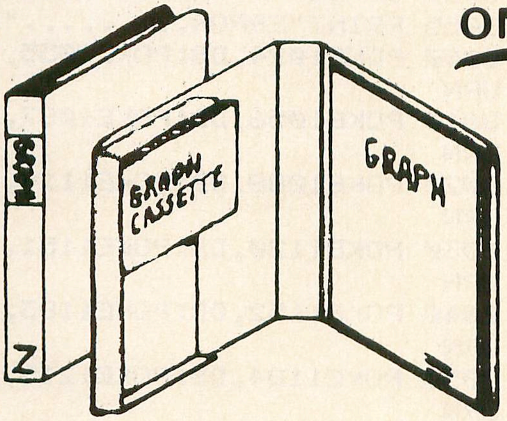

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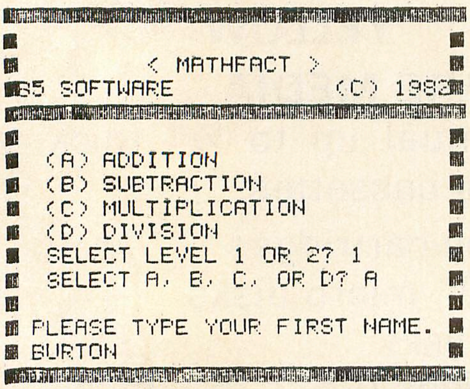
```
2080 PLAY"V30;03;T255;L255"
2090 FOR JJ=1TO30
2100 PLAY"CDEABFCD;V-"
2110 NEXT
2120 PD$="FGRPBCZXAQPLTYEIKBNTLD
FSEOKBVCXRUGJVJXOQ"
2125 CLS
2130 FOR JJ=1TO50
2140 LN=RND(5):LL=RND(35)
2150 ST$=MID$(PD$,LL,LN)
2160 PRINT@RND(510),ST$
2170 SOUND169,1
2180 NEXT
2190 RETURN
2200 RESTORE
2210 FORPQ=1TO26
2220 READWW$:NEXT
2230 DATA131,134,140.147,150
2240 DATA153,156,166,169,172
2250 DATA195,198,201,204,211
2260 DATA214,217,220,230,243
2270 DATA246,249,252
2280 FORWO=1TO RND(22)
2290 READDB
2300 NEXT
2310 RESTORE
2315 IF CG<>0 THEN GOTO3000
2320 'BUILD BORDER
2350 FORBD=1024TO1504 STEP32
2360 POKEBD,DB
2370 POKEBD-1,DB
2380 NEXT
2400 POKE1055+480,DB
2410 RETURN
3000 IF CG=1 THEN CG=0:GOTO765
3010 IF CG=2 THEN CG=0:GOTO 940
3020 IF CG=3 THEN CG=0:GOTO1110
3025 IF CG=4 THEN CG=0:GOTO1280
3030 IF CG=5 THEN CG=0:GOTO1450
3040 IF CG=6 THEN CG=0:GOTO1630
3050 IF CG=7 THEN CG=0:GOTO1790
3055 PRINT"ERROR.........":STOP
8000 POKE1024,DB:POKE1055,DB:RET
URN
8010 POKE1056,DB:POKE1087,DB:RET
URN
8020 POKE1088,DB:POKE1119,DB:RET
URN
8030 POKE1120,DB:POKE1151,DB:RET
URN
8040 POKE1152,DB:POKE1183,DB:RET
URN
8050 POKE1184,DB:POKE1215,DB:RET
URN
8060 POKE1216,DB:POKE1247,DB:RET
URN
8070 POKE1248,DB:POKE1279,DB:RET
URN
8080 POKE1280,DB:POKE1311,DB:RET
URN
8090 POKE1312,DB:POKE1343,DB:RET
URN
8100 POKE1344,DB:POKE1375,DB:RET
URN
8110 POKE1376,DB:POKE1407,DB:RET
URN
8120 POKE1408,DB:POKE1439,DB:RET
URN
8130 POKE1440,DB:POKE1471,DB:RET
URN
8140 POKE1472,DB:POKE1503,DB:RET
URN
8150 POKE1504,DB:POKE1535,DB:RET
URN
9000 GOTO20000
9045 IFNO$="Y" THEN 9095
9050 PLAY"V30;03;T255;L255"
9060 FORGL=1TO3
9070 PLAY"DEFGABC;V-"
9080 PLAY"CBAGFED;V+"
9090 NEXT
9095 NO$="":RETURN
10000 GOSUB20000
10500 IF HT$="Y" THEN RETURN
10600 POKE1058,ASC("P")
10700 POKE1059,ASC("R")
```



```
         < MATHFACT >
B5 SOFTWARE             (C) 1982

  (A) ADDITION
  (B) SUBTRACTION
  (C) MULTIPLICATION
  (D) DIVISION
  SELECT LEVEL 1 OR 2? 1
  SELECT A, B, C, OR D? A

 PLEASE TYPE YOUR FIRST NAME.
 BURTON
```

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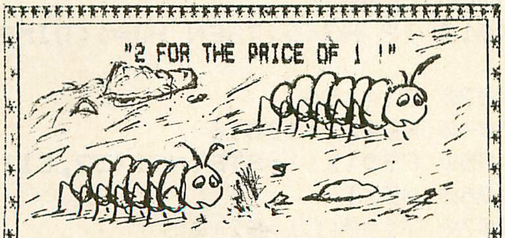
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Complex, non-commented programs are much easier to follow after using this listing utility! Multiple statements and IF. . . THEN. . .ELSE statements are logically separated, line numbers are set apart from text, page boundries are observed. Works with any printer; complete, easy to understand instruction sheet included.

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Our version of concentration. Play against the computer at different skill levels or select two player option. Some unexpected surprises add more fun, should sharpen memory skills.

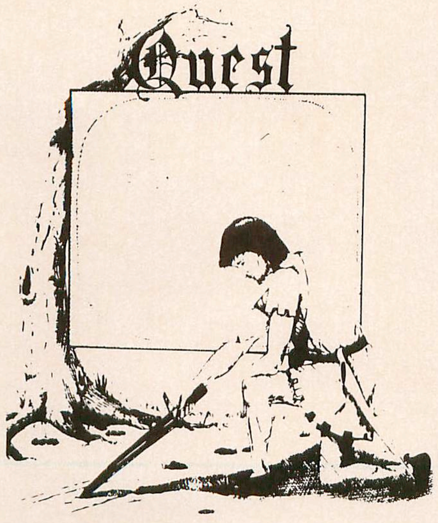
★ ★

Each program ordered must include 75¢ for Shipping and Handling.

```
10800 POKE1060,ASC("O")
10900 POKE1061,ASC("G")
11100 POKE1064,ASC("M")
11200 POKE1063,ASC("A")
11300 POKE1062,ASC("R")
11400 POKE1068,ASC("B")
11500 POKE1069,ASC("Y")
11600 POKE1131,255:POKE1163,255-
16:POKE1195,255:POKE1204,255-32:
POKE1223,255:POKE1227,255-48:POK
E1236,255:POKE1255,255-64:POKE12
56,255
11700 POKE1257,255:POKE1258,255-
16:POKE1259,255:POKE1268,255-32:
POKE1296,255:POKE1300,255-48:POK
E1328,255:POKE1329,255-64
11800 POKE1330,255:POKE1331,255-
16:POKE1332,255
13020 FORUI=1TO3
13030 PLAY"T13;L3;V30;CCDEFGAB;P
55;C"
13035 NEXT
13040 RETURN
13045 PLAY"C"
13100 HT$="Y":GOTO10000
13200 END
15000 NO$="Y":CLS:GOSUB9000
16000 PRINT@128,"  UNTIL NEXT TI
ME...   BYE!"
16010 FOR LP=1 TO 500:NEXT
17000 PLAY"V30;O3;T5;L5"
18000 PLAY"CDEFGAABBC"
19000 END
20000 CLS0
20010 IF HJ<>1THEN HJ=1:DIMFG$(1
6)
20020 C1=150
20040 FORX1=1TO16
20050 FG$(X1)=STRING$(32,C1)
20060 NEXT
20070 Y1=0:C1=C1+1
20090 FORX1=1TO16
20100 PRINT@Y1,FG$(X1);
20120 Y1=Y1+32
20130 NEXT
20140 V1=1535
20150 FORZ1=1504TO1519:POKEZ1,C1
-1:POKEV1,C1-1:V1=V1-1:NEXT
20155 RETURN
20170 IFS$="Y" THEN END
30000 CLS0:PRINT@96," "
30005 PRINT@102,"COPYRIGHT (C) 1
982"
30007 PRINT@128," "
30010 PRINT@134,"J. J. SCHMIDT"
30017 PRINT@160," "
30020 PRINT@166,"ALL RIGHTS RESE
RVED"
30030 FORYY=1TO500:NEXT:GOTO70
```

AARDVARK

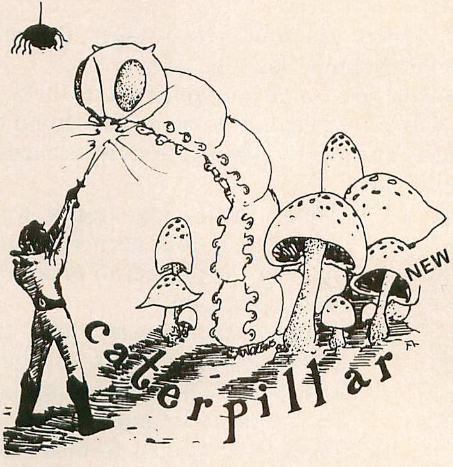
TRS-80 COLOR COMMODORE 24 VIC-20 SINCLAIR/TIMEX TI99



QUEST – A NEW IDEA IN ADVENTURE GAMES! Different from all the others. Quest is played on a computer generated map of Alesia. Your job is to gather men and supplies by combat, bargaining, exploration of ruins and temples and outright banditry. When your force is strong enough, you attack the Citadel of Moorlock in a life or death battle to the finish. Playable in 2 to 5 hours, this one is different every time. 16k TI99, TRS-80 Color, and Sinclair, 13K VIC-20. $14.95 each.

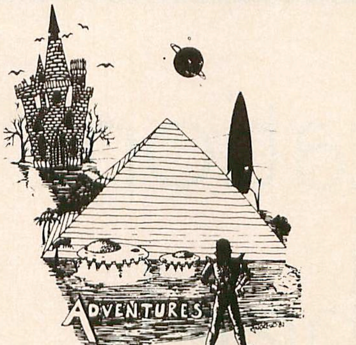
32K TRS 80 COLOR Version $24.95.

Adds a second level with dungeons and more Questing.



CATERPILLAR

O.K., the Caterpillar does look a lot like a Centipede. We have spiders, falling fleas, monsters traipsing across the screen, poison mushrooms, and a lot of other familiar stuff. COLOR 80 requires 16k and Joysticks. This is Edson's best game to date. $19.95 for TRS 80 COLOR.



ADVENTURES!!!

The Adventures below are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer, commands like "Look in the Coffin" and "Light the torch.")

Adventuring requires 16k on Sinclair, TRS-80, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Sinclair requires extended BASIC. Now available for TI99. Any Commodore 64.

$14.95 Tape – $19.95 Disk.

ESCAPE FROM MARS

(by Rodger Olsen)

This ADVENTURE takes place on the RED PLANET. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

PYRAMID (by Rodger Olsen)

This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!

DERELICT

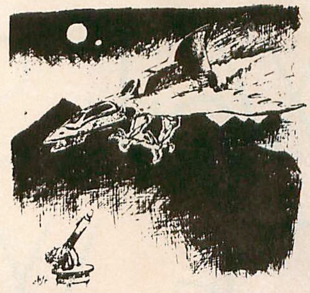
(by Rodger Olsen & Bob Anderson)

New winner in the toughest adventure from Aardvark sweepstakes. This one takes place on an alien ship that has been deserted for a thousand years – and is still dangerous!

NEW

Dungeons of Death – Just for the 16k TRS-80 COLOR, this is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. At the normal price for an Adventure ($14.95 tape, $19.95 disk), this is a giveaway.

WIZARDS TOWER – This is very similar to Quest (see above). We added wizards, magic, dragons, and dungeons to come up with a Quest with a D&D flavor. It requires 16k extended color BASIC. $14.95 Tape, $19.95 Disk. VIC 20 Commodore 64.



NEW

PLANET RAIDERS – Not just another defenders copy, this is an original program good in its own right. You pilot a one man ship across a planetary surface dogfighting with alien ships and blasting ground installations while you rescue stranded troopers. Rescue all the troopers and be transported to another harder, faster battle. Joysticks required. ALL MACHINE CODE! EDSONS BEST! 16K Tape *TRS80*COLOR $19.95 – 32K Disk $21.95.

BASIC THAT ZOOOMMS!!
AT LAST AN AFFORDABLE COMPILER!

The compiler allows you to write your programs in easy BASIC and then automatically generates a machine code equivalent that runs 50 to 150 times faster.

It does have some limitations. It takes at least 8k of RAM to run the compiler and it does only support a subset of BASIC–about 20 commands including FOR, NEXT, END, GOSUB, GOTO, IF, THEN, RETURN, END, PRINT, STOP, USR (X), PEEK, POKE, *, /, +, -, >, <, =, VARIABLE NAMES A-Z, SUBSCRIPTED VARIABLES, and INTEGER NUMBERS FORM 0-64K.

TINY COMPILER is written in BASIC. It generates native, relocatable 6502 or 6809 code. It comes with a 20-page manual and can be modified or augmented by the user. $24.95 on tape or disk for OSI, TRS-80 Color, VIC 20, or Commodore 64.

SEAWOLFE – ALL MACHINE CODE In this high speed arcade game, you lay out patterns of torpedoes ahead of the attacking PT boats. Requires Joysticks, at least 13k RAM, and fast reflexes. Lots of Color and Sound. A fun game. Tape or Disk for Vic20, Commodore 64, and TRS-80 Color.

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Work Station On Wheels

By Richard Giovanoni

This 1cc Gocart Brings Home Economy Of Organization Rather Than Mileage

This past Christmas, when I added a printer to my TRS-80 Color Computer, it became obvious that I would have to consolidate my work area. Too many cables and cords, and space was becoming a problem. Two of my sons were home from college: it's amazing how they consume food and space in an exponential relationship to their presence. Necessity, then, was the mother of my prototype portable computer center, 1cc Gocart.

Now my total operation is contained within a four-square-foot area. It's on wheels and I can retreat to any leftover space in the house. The computer, printer, recorder, tapes, notebooks and magazines have all been stacked and shelved in a converted stereo cabinet. (The cheap kind that go for about $20 on sale.) The overall setup is shown on page 2 of the plans.

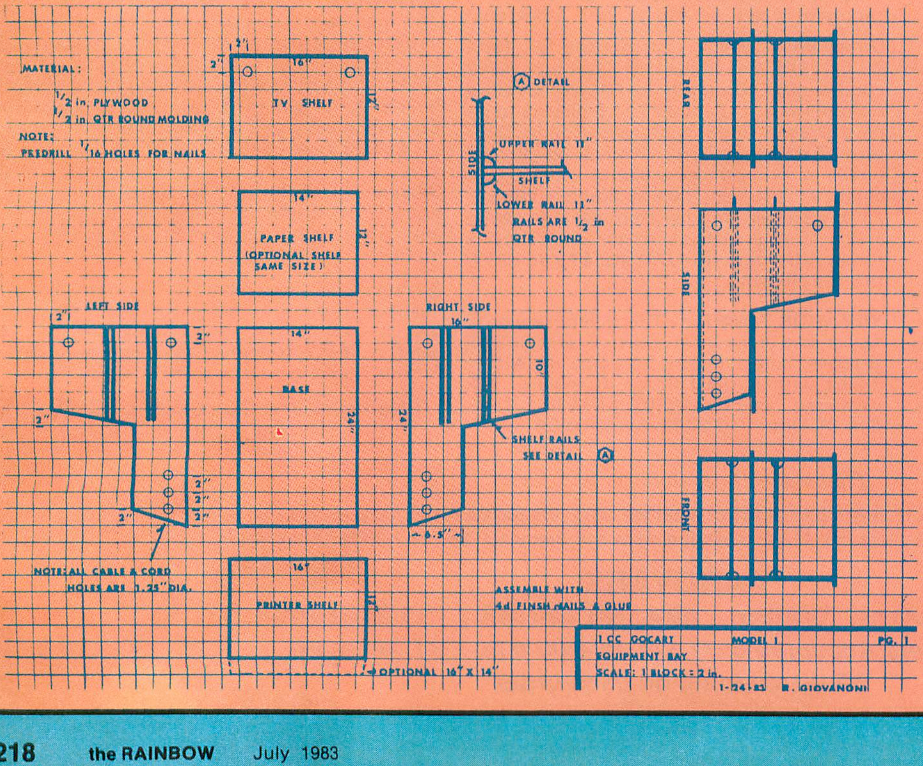
Since this was my prototype, a good deal of the construction was dictated by what odds and ends I had on hand. This included the stereo cabinet which no longer was in use. As it turned out, the system has worked so well that I haven't even taken the time to finish it up properly. The pristine beauty of its rough hewn plywood remains intact for all to admire.

Construction

Building the Gocart was done in two stages, the base and the equipment-holding upper section.

It all started with the basic stereo cabinet; it set the size, and because it was available, meant the project could be completed sooner. Five major modifications were needed to fill my requirements.

1) Metal reinforcing angles were added to all four corners on the back of the cabinet to make the unit more solid.
2) I added the casters along the bottom, using eight of them mounted on pieces of scrap one inch board. I figured eight of them were needed to distribute the load and provide stability.
3) The second sliding shelf was installed four inches down from the top. In my case this is a piece of half inch plywood, 20 x 15 inches. Strips of half-inch quarter round molding make up the rails as shown in Detail A on page 1 of the plans.
4) A 1½ inch hole was cut in the middle of the back panel about two inches down from the top so the recorder cord and cable could be brought out to the power outlet and computer.


MATERIAL:
1/2 in. PLYWOOD
1/2 in. QTR ROUND MOLDING
NOTE:
PREDRILL 1/16 HOLES FOR NAILS
2"
16"
TV SHELF
12"
14"
PAPER SHELF
(OPTIONAL SHELF SAME SIZE)
12"
LEFT SIDE
2"
2"
2"
2"
2"
2"
2"
14"
BASE
24"
24"
RIGHT SIDE
16"
10"
~6.5"~
SHELF RAILS
SEE DETAIL A
NOTE: ALL CABLE & CORD
HOLES ARE 1.25" DIA.
16"
PRINTER SHELF
12"
OPTIONAL 16" X 14"
A DETAIL
SIDE
UPPER RAIL 11"
SHELF
LOWER RAIL 11"
RAILS ARE 1/2 in
QTR ROUND
REAR
SIDE
FRONT
ASSEMBLE WITH
4d FINSH NAILS & GLUE
1CC GOCART
EQUIPMENT BAY
SCALE: 1 BLOCK = 2 in.
MODEL 1
PG. 1
1-24-83
R. GIOVANONI

5) To provide support for the TV, an end support, 12 inches wide was added to the left side between the upper and lower shelves. By inserting the extra shelf as shown, I picked up a place for my notebooks and other miscellaneous stuff that I tend to accumulate.

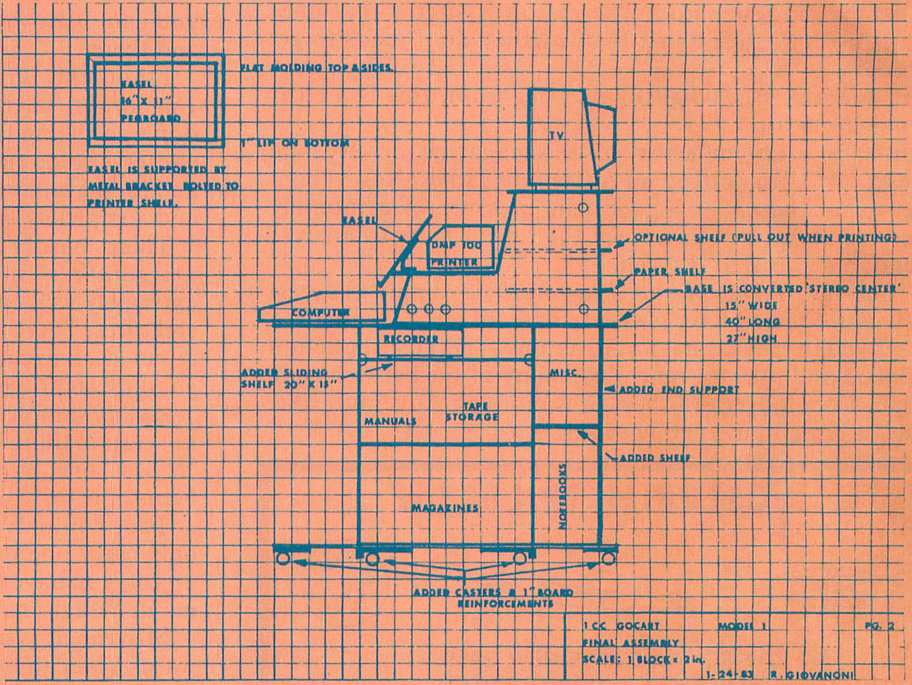
Once this task was complete I could attack the construction of the equipment bay shown in the plans on page 1.

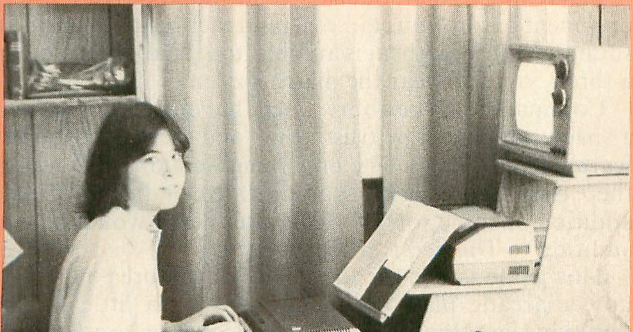
I figured out how to stack up the rest of the equipment so that I could get at, and see everything in the most efficient manner for me. I'm right handed, over six feet, and a lousy typist, all of which influenced my set up and some of the vertical dimensions.

Page 1 of the plans shows the layout of the pieces that make up the equipment bay. They were all cut out of half inch plywood. After the rails for the sliding shelves have been put on with glue and brads the sides can be assembled to the base. I used glue and four penny finish nails. By slipping in the shelves at this time the proper spacing can be maintained while the TV shelf is hammered home. At this point the unit is solid as a rock. The printer shelf is installed last. All those 1¼ inch holes are for getting the cables and cords routed to the proper place and still keeping them out of the way.

The completed bay was lined up on top of the base and clamped in place while I drilled ¼ inch holes at each end down through the top shelf of the base. Quarter-inch bolts and wing nuts installed through these holes make everything secure and allow for easy removal.

The easel holds papers or magazines when typing programs. The location is a must for me. As a hunt and peck, two-fingered typist I have to have the copy as close to the keyboard as possible. That's one of the main reasons for my "in-line" arrangement of the equipment. This setup also makes it easier to check the text against the screen when trying to find typing bugs.


FLAT MOLDING TOP & SIDES.
EASEL
16" X 11"
PEGBOARD
1" LIP ON BOTTOM
EASEL IS SUPPORTED BY METAL BRACKET BOLTED TO PRINTER SHELF.
TV
EASEL
DMP 100 PRINTER
OPTIONAL SHELF (PULL OUT WHEN PRINTING)
PAPER SHELF
BASE IS CONVERTED 'STEREO CENTER'
15" WIDE
40" LONG
27" HIGH
COMPUTER
RECORDER
ADDED SLIDING SHELF 20" X 15"
MISC.
ADDED END SUPPORT
MANUALS
TAPE STORAGE
ADDED SHELF
MAGAZINES
NOTEBOOKS
ADDED CASTERS & 1" BOARD REINFORCEMENTS
1 CC GOCART
MODEL 1
PG. 2
FINAL ASSEMBLY
SCALE: 1 BLOCK = 2 in.
1-24-83
R. GIOVANONI



My daughter, Mary, at the controls. The overall arrangement is shown with the BW portable I use most of the time. The recorder shelf is in the stored position.

To attach the easel I used an old bracket that I found in my junk box. I bent it to about a 60 degree angle and then bolted it to the front edge of the printer shelf. The easel was then attached with another bolt to the other leg of the bracket. I found that it was best for me to adjust the location of the easel so that the lower edge just rests on the top of the computer case.

The easel is a piece of leftover pegboard. I glued half-inch flat molding strips along the top and sides. A piece of one inch inside corner molding serves as a lip that forms the paper rest.

A short extension cord with three outlets is attached to the back of the cabinet near the computer end. Printer, computer and recorder power cords, fed through those 1¼ inch holes along the sides, all plug in here. It is close to my left hand so that I can unplug the computer easily at the end of a session. The excess length of the cables and cords are coiled and secured with garbage bag ties and lie out of the way on the base of the equipment bay under the printer and paper shelves.

As an example of routing, the cable from the RF modulator feeds down through the hold in the right side of the TV shelf, out the top hole in the right side, back in through the bottom hole and then to the computer port, with the excess coiled up. This path keeps it out of the way of the printer and the paper feed.

I added the optional storage shelf above the paper tray because the space was there to use. When the printer is in use I slide this shelf back out of the way.

If I had to do it over, I would make the printer shelf a couple inches deeper (as shown by the dotted lines on the plan) to give me a little more clearance for my DMP 100 printer. Obviously, this particular shelf has to be sized to whatever printer you may have. Next time I would use ball-type casters; it would be much easier when moving over carpeted areas. I am still trying to figure out how to add a built-in light.

I'm really happy with the setup and hope that it contains some ideas useful to others.

Dungeons Of Daggorath
New Adventure Standard

(Editor's Note: This review is made possible through an advance copy of the program provided to ***the Rainbow*** *by Radio Shack.)*

We seem to be breaking frontiers all over the place for CoCo these days. The arcade games get better and better yet; the utilities become more and more powerful; the abilities of our favorite computer seem to grow more and more each month in regard to data bases, word processing and the like.

Now, in the world of Adventure gaming, there is a new standard. It is called *Dungeons of Daggorath.* It is from Radio Shack, available in a Program Pax.

Frankly, it is one of a kind—yet I expect to see more of its ilk in the months ahead. The reason is simply that once someone does something, the *way* they do it tends to get around.

In the case of *Dungeons of Daggorath,* this is a clear bonus for us all.

As most everyone who reads this magazine for very long will know, I am hooked on Adventure games. Now, I confess to not being very good (the pressure of a monthly deadline seems to slow down the time I have to analyze them), but I *love* to play 'em.

Thus far, *Dungeons of Daggorath* is simply the best Adventure game I have played to date. In fact, it is almost a falsehood to say that it is an Adventure—because the action gets fast and furious, much like many of the better arcade games I've enjoyed. In short, it is more an Adventure/Arcade offering than anything else!

Thanks to an advance copy of both the documentation and the Program Pak, we can probably stay ahead of some of you until next month—that's when *Dungeons of Daggorath* goes on sale at your local Radio Shack stores and dealerships. But, while we are, so far, the number one player of this excellent offering, it is only fair that we tell you something about it (this is a review, isn't it?)

Dungeons of Daggorath is a three level, real time Adventure that makes you do a bit of thinking and a lot of fast reacting all at once. But, it also won't let you go too fast. Oh, I'm getting ahead of myself . . .

The screen is divided into three segments—one which shows the area you are in—in G 3D-type maze format, the second showing what you are holding (if anything) in each hand. At the bottom of all this is a four-line "command area" that lets you enter commands.

In the middle of the status area is a beating heart—yours. As you exert yourself, the heart beats faster and faster. If it gets going too fast, you're a goner—which means you can't rush through room after room. If you do, you'll be out of breath and the smallest, tiniest spider might do you in. Or, you can just overexert yourself and burst your heart then and there.

I think this is the most true to life aspect of *Dungeons of Daggorath.* Face facts: If you are a real adventurer, you don't go racing from room to room. And, you do have to conserve some energy. A lot of programs do this with water and food availability—but *Dungeons* handles it in real time and completely true to life.

This is hardly the only thing which makes *Dungeons of Daggorath* a superior program, however, the maze is extremely well constructed and populated with all sorts of creatures. There are also various kinds of objects—and different *levels* of each object. The stronger the object, the more good it can do you.

As an example, you start with a wooden sword, which can kill certain things. But there is also an iron sword . . . and an "elvish" one, as well. The more powerful the sword, the better it is for you!

Too, you only have two hands, and generally, you can only carry one thing at a time in each. To actually use an object, you have to specify the hand in which you are carrying it. You do have a pack, though, to stow other things.

Movement is easy, using just the "M" key to move forward. You can turn around, turn right or left and the like. You can also move backwards (backpedal), something that is often necessary in a fight to get your heart slowed down a bit.

Incidentally, the sound is fantastic. You can hear an opponent before you can see it (and each has its own distinct sound). Your heartbeat is audible, too. And, when you light a torch, you can hear the match sizzle.

Commands can be abbreviated (but must be separated by a space, which can be frustrating) and there is a save game feature (to cassette). The only thing we didn't like was that there is no "score" *per se,* you either live or die. We think the addition of some sort of status after death would be a nice addition to *Dungeons of Daggorath.*

This game is not for the novice adventurer, nor for the novice arcade player, either. But, with a little skill and thinking (fast thinking), *Dungeons of Daggorath* will provide you with more fun than you've had in quite a while.

Dungeons of Daggorath: A great game!

(At Radio Shack stores, dealers and computer centers, $29.95)

—Lonnie Falk

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Fastape: ML Utility Allows High Speed I/O

Much has been said lately about the high-speed, or vitamin E *POKE* for our CoCo. While in this mode, BASIC programs will run about 30 percent faster, making number crunching and arcade-type programs execute at a more satisfactory speed. The major problem in using high-speed is that you cannot do any I/O operations to your cassette, printer, or disk. If you do, you will find out the true meaning of "I/O error" or possibly a "locked up" system. What we need is a way to have our cake and eat it too.

Fastape is a machine language utility that will solve most of these problems. With it, you can save and load programs and data from cassette, and use your printer, all while remaining in high-speed mode. Once loaded, the program will auto-execute and automatically adjust itself for the amount of memory you have. Unlike most machine language utilities, it is not necessary to reserve space for it, by means of a *CLEAR* statement, before loading it in.

Using *Fastape* could not be easier. It operates in four modes. The first two are the high and low (or normal) speed CPU modes. These modes will have your CoCo running in either the high or low speed mode of operation, just as if you had entered the proper *POKEs*. Each of these modes, in turn, have two speed modes for cassette operations. The high speed cassette mode will save and load your files in almost exactly one-half the normal time. Unbelievable, but true! The low speed mode (did you guess it already?) operates just as if the program was not running.

With the combination of these four modes, you can save or load data in any desired format. This allows for the necessary flexibility when you first start to use the program, by enabling you to load your existing tapes, and then to save them out in the high-speed format. You can even load tapes created in the high-speed CPU mode that were saved without using the program (possibly by accident).

When using your printer with *Fastape*, it will automatically adjust the baud rate for you, so that your printer will produce the listings you want, instead of garbage. If you operate your printer at a rate other than the default of 600 baud, all you have to do is to enter the necessary *POKE* prior to loading the program, or while it is running in the low-speed CPU mode.

Switching between operating modes is accomplished by holding down the "control" (down arrow) key and pressing the number 1 to 4 key, depending on which of the modes you want. The control key can also be used to speed up the entry of some common BASIC commands. These include the audio, motor, and cassette commands, as well as a few others. In addition, you can use it to find out which of the modes you are in, in case you have forgotten.

Fastape is a great utility program that should prove to be boon to all cassette users. The documentation explains everything you need to know in order to use it without any problems, and it works like a champ. If you are tired of waiting for those tapes to load, I strongly recommend that you buy this fine utility. If I could only figure out how it works.

(SpectroSystems, 11111 North Kendall Drive, Suite A108, Miami, FL 33176, $21.95 tape)

—Gerry Schechter

Federal Hill Software

Coco-Acountant!

Were your taxes a mess this year? Make those deductions a breeze! Use data from up to 450 canceled checks for reports of expenditures by month, account of payee! Flags deductible checks, checks subject to sales tax--even computes the sales tax you paid. Lists to screen or printer. $15.95 on tape, $21.95 on disk. **32K CREDIT ACCOUNTANT** performs same functions for credit card expenditures. Only $9.95 when ordered with Coco-Accountant (tape or disk).

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Morocco Gran Prix Roars With Action

In *Morocco Gran Prix,* Computerware's newest graphics game for the Color Computer, you are a pit crew member at the local race track. During qualifications, the world famous race driver Juan "el Racero" Gomez becomes sick on gasoline vapors. You decide to take advantage of the opportunity to take the high powered racer for a test drive, but little did you know that the race would begin as soon as you hit the track.

Once the game has loaded, you see the instruction screen. The racer is controlled with the right joystick. Left to right controls your steering, while forward and back controls your speed.

An overhead view of the brightly colored racer appears at the pits on the side. To begin the game just cross over the guard rail. A timer is instantly activated and the race is on! The timer begins counting down at 100 seconds. Points are awarded for the amount of time you stay on the track. The faster you drive, the more points you accumulate. If you crash, you end up at the pits on the side. To re-enter the track, just cross over the guard rail. Occasionally, you encounter night driving conditions and snow covered roads, just to keep you from getting bored. There are also a few surprises, such as fire trucks and the like. If you get over 2000 points by the time the timer runs out, you are awarded with an extended play. *Morocco Gran Prix* keeps track of the top ten scores.

The wisest strategy when racing is to start off fast. Once you pass by a car, don't worry about it anymore—it's out of the picture. All danger lies ahead. Develop a sense of timing early in the game as to how frequently other autos show up. At those times, slow down and survey the scene. If the racers ahead can be easily passed, then resume top speed. Of course, the best strategy is practice. And that's what you'll want to do, because *Morocco Gran Prix* is addicting!

Not only is the action portion of *Morocco Gran Prix* spectacular, but the game is a visual triumph as well. The racers themselves are handsomely detailed with color rivaling most coin-op video games. The only things missing are curves and road signs. The track remains straight throughout the entire game, and there are no road signs to add to the visual effects of the game. A red caution flag does appear once in a great while just before the fire truck hits the track. The sound effects are about average for the Color Computer, and are nothing short of spectacular when you crash (though it would be nice if the fire truck had a siren!).

Morocco Gran Prix is delightful to look at and a blast to play. Computerware should be congratulated for their work in this new racing game for the Color Computer.

(Computerware, Box 668, Encinitas, CA 92024, 32K Machine Language, $24.95)

—Barry Younce

Fast Action And Great Graphics Make *Planet Invasion* Challenging

As I loaded this 16K machine language program from Spectral Associates into my CoCo, I sighed at the prospect of what I thought would be just another space arcade game, but I soon discovered that the outstanding graphics and animation put this game in a class by itself.

Planet Invasion is a "*Defender* -type" arcade game. You are required to cruise above the planet's surface locating and destroying wave after wave of Praetorian invaders. The playing area extends off the screen in both directions, but author Steve Geiseking had the foresight to provide our ship with a long range scanner which helps determing the exact locations of the invaders. You are given a certain amount of time to destroy each wave or the invaders will begin to fire chasers at you, and these are extremely difficult to avoid. Developing an ability to use the long range scanner is important because it will save you a lot of time and will help to destroy a wave quickly before any of the deadly chasers appear.

In addition to the chasers, each wave is made up of different types of enemy craft, each with different characteristics. Grabbers will fire at you while they lower themselves to the planet's surface in order to grab the caloxin crystals which dot the terrain. After grabbing a caloxin crystal, they lift off and begin moving toward the top of the screen. There are two reasons why it is important to destroy the grabbers before they ascend to the top of the screen. First, if a grabber succeeds in reaching the top with a caloxin crystal it becomes a killer—a deadly, intelligent craft which seeks you out and spews rapid fire. Second, if the enemy succeeds in capturing or destroying all your caloxin crystals, you will be forced to fight "in the outer reaches of space far from the planet's surface." What this means is that the display of the planet's terrain disappears and only your ship and those of the enemy are displayed. Before this happened to me the first time I didn't think that it would make much difference, but, boy, does it! Without the surface of the planet scrolling by beneath you all sense of speed is lost and tracking and destroying the enemy becomes doubly difficult.

You can avoid this calamity by preserving your caloxin crystals. There are three ways to do this. First, of course, you can destroy the grabbers before they seize any crystals. This is an okay strategy for about the first two waves; after that, there are just too many of them for this to be effective. Second, you can destroy a grabber after it has seized a crystal and begun its acent. If the grabber is destroyed at a low altitude, the caloxin crystal will drop back to the planet's surface unharmed. Finally, if you are forced to destroy a grabber with a crystal at a high altitude you can catch the caloxin crystal in mid-air and return it safely to the planet's surface; otherwise the crystal will be destroyed when it hits the surface.

In addition to the pesky grabbers and chasers, the Praetorians have an array of sophisticated weaponry pitted against you. Among these are miners which move slowly about the screen leaving mines which will destroy you if you collide with them. The only good thing about miners is that they are relatively easy to shoot down because they move so slowly. Beamers are deceptive; they sit there barely moving and are very easy to hit, but when hit, they split into three berserkers and, boy, is that an appropriate name! These little attackers are difficult to shoot down because of their small size and their violently evasive maneuvers. They are intelligent trackers and literally spew out lethal rapid fire.

Fortunately our ship is equipped with three "smart bombs" which, when released, destroy all enemy ships presently on the screen. However, there are so few of them that one must be very judicious in their use. Fire them only when the screen is crammed with Praetorians or when you are threatened by a chaser.

Your ship is controlled by a combination of joystick and keyboard inputs. The right joystick controls elevation, direction and speed. If the joystick is positioned to the left, our craft moves to the left (that is, the screen scrolls to the right) and the further left the joystick is moved the faster the ship moves. I like this combination of speed and direction in one control. The fire button controls the laser fire and if you hold the button down you get continuous rapid fire, a feature I like very much. It really saves wear and tear on the old trigger finger. There is a tendency to fly along with the laser firing at all times but this doesn't really give you much of an advantage. Pressing the space bar fires one of the smart bombs, and pressing the "H" key moves your ship into hyperspace; that is, it moves you immediately to some other portion of the battle area. This can be very helpful when you find yourself in an area teeming with Praetorians and you want to get out fast.

On-screen scoring is provided and also high score for the session is displayed. You are also kept informed as to the number of ships remaining, the number of smart bombs remaining and the current Praetorian wave number. Documentation is adequate.

If you enjoy good space games then this one is for you. Another plus: Spectral Associates says it will replace the tape for only $1.50 should it be accidentally erased or become unusable for any other reason. (How can you go wrong with a deal like that?) For disk users, instructions are provided for transferring the program to disk.

(Spectral Associates, 141 Harvard Avenue, Tacoma, WA 98455, $21.95)

—David Johnson

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The following products have been recently received by *the Rainbow*, examined by our magazine staff and approved for the *Rainbow Seal of Certification*, your assurance that we have seen the product and have ascertained that it is what it purports to be.

This month the *Seal of Certification* has been issued to:

Scramble, a 16K word game for two to four players. Objective: opponents alternate entering a 4-15 letter word, the computer scrambles the word, and your opponent must unscramble the word in 2½ minutes. Four skill levels. Kaleidoscopic Creations, P.O. Box 1284, Melrose Park, IL 60160, tape $15.95.

The Computer Camp Book, a (8½" x 11", 227-page, soft-cover) book on computer camps and how to become a computer literate. First, it is a manual on how to start your own computer camp; second, it is a guide to computer camps, and third, it tells you how to become a computer literate. YSCC, 8327 Sheridan Lane, Eden Prairie, MN, $12.95.

TNT-ALYZ, an electronic circuit analysis program of interest to electronic hobbyists, hams, and engineers. This program is capable of computing the gain and phase response of complex electronic circuits. Includes a 30-page manual. TNT Software, Route 2, Box 76 D, Manor, TX 78653, tape $29.95.

Fastape, a 32K program which doubles the speed of your cassette operations and allows you full use of your cassette and printer, while the computer is running at high speed mode. Spectro Systems, 11111 N. Kendall Drive, Suite A-108, Miami, FL 33176, tape $21.95.

Function Graphing Module, a 16K program that allows you to graph functions of a single variable on the high resolution graphics screen of your computer. Includes a 53-page manual. Calcsoft, P.O. Box 401, St. Ann, MO 63074, tape $19.95.

Amortise, a 16K program which allows you to print amotization charts. Showing for each month, the date due, amount to principal, amount to interest, total interest to date, balance still owing and totals for each year. Dataman, Box 431, Station B, Hamilton, Ontario, Canada L8L 7W2, tape $9.95.

CoCo Copy, a 16K machine language program that will copy BASIC or machine language programs including most automatic start programs. Dataman, Box 431, Station B, Hamilton, Ontario, Canada L8L 7W2, tape $12.95.

Pretty Printer, a 16K machine language utility program that will allow you to write your code in a compact form and list to the screen or printer in an easy to read format. Dataman, Box 431, Station B, Hamilton, Ontario, Canada L8L 7W2, tape $12.95.

P.U.F.F., Printer Utility File Formatter, a 16K program which turns any word processor into a super printer formatter. Dataman, Box 431, Station B, Hamilton, Ontario, Canada, L8L 7W2, tape $24.95.

Fraction Math Quiz, a 16K drill program with five skill levels from introductory elementary school to advanced high school fractions. Includes seven fraction operations and multiple choice format. Creative Technical Consultants, P.O. Box 652, Cedar Crest, NM 87008, tape $14.95.

Fire Copter, a 32K full color graphics game for one to two players. Objective: you are aboard the *Fire Copter*, trying to keep your city from being burned to the ground by the minions of Pyro Maniac—the firedroids, while putting out the fires and destroying the firedroids. Adventure International, P.O. Box 3435, Longwood, FL 32750, tape $24.95.

Sea Dragon, a 32K arcade game with seven skill levels for one or two players. Objective: you are sea captain of the nuclear sub—the *Sea Dragon;* make it through the mine field to reach your target—the Master mine—as you snake through treacherous underwater passages, avoiding mines, depth charges, stalactites, and enemy attack stations along your way. Adventure International, P.O. Box 3435, Longwood, FL 32750, tape $34.95.

Grafplot, a 16K graph drawing program used to turn your computer into a data plotter producing graphs of any type of X-Y data. Hawkes Research Services, 1442 Sixth Street, Berkeley, CA 94710, Tape $35, 32K disk $45.

An Adventure in Murder, a mystery game. Objective: you are a detective hired to find the murderer of Mrs. McDermitt. While searching through her four-floor mansion you are given clues and a list of suspects enabling you to determine the murderer. Mr. R's Software, 68 Kelly Road, South Windsor, CT 06074, tape $14.95.

Zarconian Marble, a 16K checker-style strategy game for one or two players. Objective: play against the computer or an opponent and be the first to either get five marbles in a row or first to make five captures. CoCo Hut, P.O. Box 24451, Houston, TX 77015, tape $19.95.

8-Ball, (Rom Pac) a 16K arcade-type pool game for two players. Objective: try and be first to sink all of your balls and then the *8-ball* to win the game. Anteco Software, P.O. Box 14728, 4220 Clay Avenue, Fort Worth, TX 67117, $29.95.

Family, a 32K genealogical data base program for up to eight generations and 255 ancestors. Prints pedigree charts, family groups and a reference index. Available from The Word Merchant, P.O. Box 232, Lititz, PA 17543, tape $9.95.

Pie Chart, a 16K graphing program which allows you to enter data such as monthly bills, yearly expenditures, etc. Harmonycs, P.O.Box 1573, Salt Lake City, UT 84110, tape $10.95.

Help! Color Computer Reference System, a (4" x 6", 99-page, ringbound, soft-cover) reference system designed to provide the beginning programmer with the essential information needed to write personal and workable programs. Wright Books, 54 Vly Road, Albany, NY 12205, $9.95.

Rainbow-Writer, a 16K high resolution graphics text display utility which allows you to write text on any graphics screen in rainbow colors. Rainbow Connection Software, 3514 6th Place, NW, Rochester, MN 55901, disk $32.95.

Electronic Calligrapher, a 16K disk based calligraphing program that when used with a printer capable of dot matrix graphics will print any line, up to 25 characters, in either an Old English or Chancery cursive-type font. DSL Computer Products, Inc. 13726 West Warren, Dearborn, MI 48126, disk $18.95.

Pie Zapper, a high resolution graphics program that produces pie charts on the screen. Includes a 26-page manual. Southern Software Systems, 485 Tropical Trail, Suite 109, Merritt Island, FL 32952, tape $15.95, disk $19.95.

Convert, a 16K program that will convert units of length, volume, area or weight from, or to, the equivalent imperial, metric, nautical or historical systems of measurement. Dataman, Box 431, Station B, Hamilton, Ontario, Canada L8L 7W2, tape $9.95.

Filmastr, a general purpose database manager in data entry screen format which holds up to 20 data fields. The Computer House, Box 1051, DuBois, PA 15801, tape $29.95, disk $34.95.

Time & Money, a financial planning aid that will determine the value of investments and compare various methods of handling investments. The Computer House, Box 1051, DuBois, PA 15801, tape $19.95, disk $24.95.

Master Control II, a 16K machine language program designed to increase the speed it takes to write BASIC programs. Includes a plastic keyboard overlay. Soft Sector Marketing, Inc., 6250 Middlebelt, Garden City, MI 48135, tape $19.95. SSM is offering owners of the original Master Control an update to the newer version for $8 plus $2 S & H.

Color Graphics Editor (CGE), a 16K machine language program that allows you to create on screen high resolution graphics which can also be transferred to disk. Soft Sector Marketing, Inc., 6250 Middlebelt, Garden City, MI 48135, tape $19.95.

Color Caterpillar, a 16K machine language arcade-style game for one or two players. Objective: destroy the caterpillar in segments by firing missiles and gaining points by killing off mushrooms, tarantulas, and beetles. Soft Sector Marketing, Inc., 6250 Middlebelt, Garden City, MI 48135, tape $19.95.

Colonial Trilogy, a series of three new 32K games with high resolution graphics. Volume I, **Colonial Wars,** a two-player space battle game with a split screen concept. Objective: colonize and battle for control of an eleven-star system while commanding massive battle carriers, fighter squadrons, freighters and planetary defenses. Volume II, **Zyron,** a space battle game for two players. Objective: battle within an asteroid field while one player tries to slip freighters past the others' defenses. Volume III, **Questar,** an adventure game for one player. Objective: explore over 30 planets and encounter unknown civilizations, deserted cities, and busy starports while searching for hidden Zyron bases. HYCOMP, P.O. Box 15331, Tulsa, OK 74158, $19.95 each or all three tapes for $49.95.

BLACKJAQ!, a 16K casino simulation card game of "21" for one to five players. Objective: beat the dealer's hand without going over 21 points. Federal Hill Software, 825 William Street, Baltimore, MD 21230, tape $19.95.

Harness Handicapper, a 16K program that applies established handicapping techniques and the power of the computer to the ratings of harness horses, which will enable you to improve your betting performances at the race track. Federal Hill Software, 825 William Street, Baltimore, MD 21230, tape $24.95.

CoCo Accountant, a 32K home or small business accounting program that allows you to keep records of yearly expenses while providing information at tax time without the task of sorting through cancelled checks. Federal Hill Software, 825 William Street, Baltimore, MD 21230, tape $15.95, disk $21.95.

Printer Artist, a 16K four-program cassette and tutorial package on computer art. Includes two programs containing 12 ready to run pictures and an instruction booklet for 49 other drawings which can be created, printed and saved to tape or disk using the two utility programs which will enable you to use those instructions to create pictures. Federal Hill Software, 825 William Street, Baltimore, MD 21230, disk $19.95.

Pick Which, a 16K machine language game for all ages. Objective: search the screen in an effort to choose the most desirable picture. Detailed pictures fill the screen along with sounds. Spectral Associates, 141 Harvard Avenue, Tacoma, WA 98466, tape $9.95.

Space Race, a 16K RAM machine language game with high resolution graphics and sound. Objective: maneuver your ship around the four-cornered race track while destroying alien ships and watching out for mines laid by the swarmers. Spectral Associates, 141 Harvard Avenue, Tacoma, WA 98466, tape $21.95.

C-Trek, a 16K space combat game. Objective: you are the captain of the ship and it is your task to destroy all the invading forces before they can launch their attack on the Federal seats of power. Spectral Associates, 141 Harvard Avenue, Tacoma, WA 98466, tape $8.95.

Color Zap, a 16K high resolution graphics arcade game with 15 skill levels and sound. Objective: zap the onslaught of alien attacking ships as they seek to destroy you to gain entrance to the Stargate—which you are defending. Spectral Associates, 141 Harvard Avenue, Tacoma, WA 98466, tape $9.95.

Home Money Manager, a disk-based personal checkbook system. It tracks data by date, paid to, check number, account number, amount of check, and current balance. Each of the printed reports will show monthly deposit total, expense total, gain or loss, and current balance. Computerware, Box 668, Encinitas, CA 92024, disk $19.95.

Introduction to Data Communications, a five part, 16K program requiring Extended BASIC, designed to teach beginners the basic ideas and terminology to use a data communications device. Computerware, Box 668, Encinitas, CA 92024, tape $17.95.

Moon Hooper, a 32K arcade game with five skill levels. Objective: you are out on test maneuvers in the new exploration machine, the *Moon Hooper* and must avoid being blasted by enemy saucers while firing phasers and racing toward your home base. Computerware, Box 668, Encinitas, CA 92024, tape $24.95.

Morocco Gran Prix, a 32K race car game. Objective: you are part of the pit crew and in Juan "el Racero" Gomez's absence, you sneakingly take his high-powered racer out for a test drive and are caught in the middle of the actual race. See how well you can do, avoiding crashes and demolitions. Computerware, Box 668, Encinitas, CA 92024, tape $21.95.

Indexer, a 16K machine language utility program which produces a sorted list of variables and line numbers used in your BASIC program. ML-US'R Software, 115 Rising Sun, Fort Mitchell, KY 41017, tape $14.95.

Label III, a 16K mail list program which will print lists or labels of three or four line addresses and a telephone number. Owls Nest Software, P.O. Box 579, Ooltewah, TN 37363, tape $19.95.

Clock, a 16K machine language time clock program that uses the interrupt that is generated by the VDG. Chroma-Systems Group, P.O. Box 366, Dayton, OH 45420, tape $9.95.

CCADS, Color Computer Assembly Language Debugging System, a 16K complete language software development monitor. Included are a 6809 line assembler and disassembler, hex and ASCII memory dump, memory alteration routines, serial printer capabilities, and a user software execution controller with six breakpoints, and user register storage and modification. Chroma-Systems Group, P.O. Box 366, Dayton, OH 45420, tape $19.95.

Unlock, a menu driven disk backup utility which produces copies of diskettes that cannot be backed up using the BACK UP command from BASIC. Chroma-Systems Group, P.O. Box 366, Dayton, OH 45420, disk $24.95.

Chroma-Keys, a 16K utility program that will reduce the amount of time required to key in magazine listings by adding a click sound when a key is pressed. Chroma-Systems Group, P.O. Box 366, Dayton, OH 45420, tape $9.95.

Program File, a 16K Extended BASIC program that will organize your cassettes. Owls Nest Software, P.O. Box 579, Ooltewah, TN 37363, tape $14.95.

Kodomo-no-go, a 16K or 32K Japaneese named game for five in a row played on a 19 x 19 board. For one or two players and four skill levels. This game is similar to tic-tac-toe which is also included on both tapes. Intercept Enterprises, P.O. Box 4016, Cherry Hill, NJ 08034, 16K tape $14.95, 32K tape $19.95.

Fundfile, a 16K Extended BASIC portfolio and account management program for securities. Creates files for up to 900 transactions and 50 securities. Parsons Software, Dept. A, 118 Woodshire Drive, Parkersburg, WV 26101, disk $27.95.

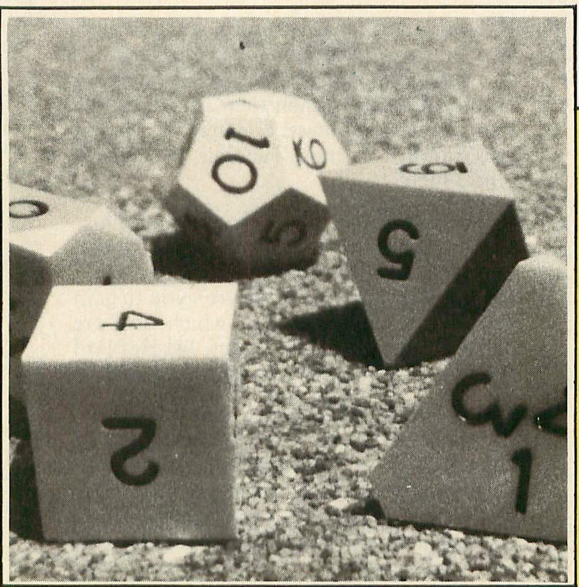
The *Seal of Certification* program is open to all manufacturers of products for the TRS-80 Color Computer, the TDP-100, or the Dragon-32, regardless of whether they advertise in *the Rainbow*. By awarding a *Seal*, the magazine certifies the program *does exist*, but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to *the Rainbow's* reviewers for evaluation.

—Jutta Kapfhammer

16K
ECB

UNDERSTANDING PROBABILITY WILL IMPROVE YOUR ODDS

By Linda Nielsen



Having spent a little time in Las Vegas recently (most of it at the Consumer Electronics Show, honest!), I thought it might be interesting to write a bit about programs to calculate the probabilities for some games of chance. This is my way of beginning to talk about the whole area of programming probability and statistics.

Interestingly enough, there is no generally accepted definition of probability among mathematicians, even though everyone has an intuitive understanding of what probability means. The classical interpretation of probability, and the one I will use, depends on the concept of equally likely events. For example, if you flip a coin and it has an equal chance of showing a "heads" or a "tails," then each of those outcomes has a ½ or 50 percent probability. It may be hard to imagine how equally likely events can be found in weather forecasting, but they are quite common in games of chance.

Let's examine what happens when a single die is thrown. Imagine this die is one of those six-sided kinds you once used in Monopoly or that you see at crap tables in Las Vegas. Before you ever throw that cube, you know that when it lands, a side will be showing on the top. You also know that the top side will have between one and six spots on it. You know that you are not going to see one side with two hundred little spots on it. So you simply throw away the idea of getting two hundred. A statistician would say that the probability of getting two hundred in one roll of an ordinary six-sided die is zero.

On the other hand, if the die has already been thrown but you can't see the top side, you can still imagine the probabilities. If you don't know what happened, from your perspective the outcome is still uncertain even though the event happened in the past.

Since you know for certain that the number of dots showing will be between one and six, we say that the probability of a whole number between one and six is equal to one. The probability of the sure or certain event is always equal to one.

If this is a fair die, then each of the outcomes one through six is equally likely. An unfair die is

DANGER RANGER

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Your joystick controls Danger Ranger on his mission to make the universe safe for Mom, Brotherhood and The American Way. First, our hero finds himself in the surrealistic 'Chamber of Pasha,' which consists of five consecutive platforms. Danger Ranger has to blast his way through radioactive bats and roving eyes to pick up the ten keys that may spell the difference betwen survival and death for the human race!

If Danger Ranger can muster enough skill and courage to survive those challenges, he'll enter the 'Acid Chamber.' Here, not only do demons guard the treasure boxes he wants to collect, but fatal drops of acid fall from the ceiling and rise from the floor. Not a nice way to make a living - but it makes one heck of a video game.

Danger Ranger, from **ScreenPlay.**

Poor Winky. Lucky you.

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one of those that usually or always shows a particular number on the top and you wouldn't want to mess with one like that. (In a future article I will discuss how you could write a program to do a good job of guessing if a particular die is a fair one or not.) If each of the numbers, one through six, is equally likely then probability of any particular number coming up must be 1/6. If we built a fair die with four sides numbered one through four, then the probability of each number between one and four being the number on the bottom would be 1/4. Similarly, a fair, 20-sided die numbered from one to 20 has a 1/20 chance of showing each number between one and 20 and a zero probability of any other outcome.

The probability of getting a number less than five on a six-sided die would be the probability of getting a one or a two or a three or a four. It isn't possible to get both a two and a three in one roll so we can add the probabilities of one, two, three and four to arrive at the probability that the number will be less than five. That is 1/6+1/6+1/6+1/6 or 4/6=.66667.

Now we are ready to write a simple program to calculate the probability of some outcomes from a single throw of an "N" sided die. First clean up the screen, then query the user for the number of sides on the die.

```
100CLS:INPUT"HOW MANY SIDES ON THE DIE";N
```

Next calculate the probability of each number using the formula: probability=1/number of sides.

```
110P=1/N:PRINT"THE PROBABILITY OF EACH
NUMBER FROM 1 to "'N;"IS";P
```

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Next, put in a program loop to calculate the probability that the number of the die will be less than each of the numbers from 1 to the highest number that exists on the die. Statisticians call this a cumulative probability table and you can see why:

```
120 FOR J=1 TO N:T=0:FOR K=1 TOJ‘ T=P+T:NEXTK
130PRINT"PROBABILITY OF <=";J;"IS ";
140PRINT USING "#.#####";T: NEXT J
```

If you want the program to return to the beginning to accept new parameters, then add these lines:

```
160 R$=INKEY$:IF R$="" THEN 160
170 GOTO 100
```

If you want the cumulative probability table to be sent to the printer then change line 140 and add line 150:

```
140 PRINT USING"#.#####";T;
150 PRINT#-2,"THE PROBABILITY OF <=";J;" = ";T:
NEXT J
```

Now let us consider a more interesting question. Most games of chance involve throwing more than one die. The most common one I know of is the game of craps in which two, six-sided dice are thrown. But there are also games like *Dungeons and Dragons* which use one or more four, six, eight, twelve and twenty-sided dice. Next, we will write a program to determine the probability of any selected number when you throw from one to five "N" sided dice. Clean up the screen and ask the user for the number of dice and the number of sides on each of the die.

```
100CLS:INPUT "HOW MANY DICE (1-5)";D : INPUT
"HOW MANY SIDES";N
```

Suppose we are throwing three, four-sided dice. Each of these dice is an equilateral pyramid with sides numbered one through four. When it lands there are three sides showing and one facing down. Imagine that the dice are different colors so we can distinguish among the first, second and third die. The first die has a 1/4 chance of having a one on the bottom side. Assuming, (and it seems a safe assumption) that the dice don't influence each other, the second and third die also have a 1/4 chance of showing a one on the bottom. Then the probability of a total throw of three is (1/4)*(1/4)*(1/4) or 1/64 which is 0.015625.

Consider the event that the first die has a three, the second die has a two and the third die has a one on the bottom. This exact event also has a probability of (1/4)*(1/4)*(1/4) or 0.015625. Notice, however, that the sum of the die is now 3+2+1 or six, and we can get a six in several different ways. In tabular form we could get a six by:

First Die	Second Die	Third Die
1	1	4
1	4	1
4	1	1
1	2	3
1	3	2
2	1	3
2	3	1
3	1	2
3	2	1
2	2	2

In all there are ten different ways that we could get a six from the roll of three four-sided dice. Each of these ten different sequences is equally likely. That is, each of the sequences has a probability of 0.015625. Nevertheless, when rolling several dice, we are usually interested in the sum and not in the precise order of each die. So if we are interested in the probability of a six in this example it would be 0.015625 + 0.015625 + 0.015625 etc for ten times. More simply, that is 10 x 0.015625 or 0.15625.

We want to use our program to calculate the probability of each simple (or equally likely) event and then add up all the occurrences of this particular event. The next line of the program calculates the probability of each simple event:

```
110 P=(1/N)↑D
```

The next line of the program asks the user what number is wanted and sets the program variables to zero:

```
120 INPUT“YOU WANT”l:: T=0: E=0: F=0: G=0: H=0:
M=0
```

Then we want to calculate the occurrences of the chosen number, L, over all the dice and all the numbers one through N:

```
130 IF D=1 THEN T=P: GOTO300
140 IF D>4 THEN FOR E=1 TO N
150 IF D>3 THEN FOR F=1 TO N
160 IF D>2 THEN FOR G=1 TO N
170 IF D>1 THEN FOR H=1 TO N
180 FOR M=1 TO N
190 Z=E+F+G+H+M
200 IF Z=L THEN T=T+P
210 NEXT M:NEXT H: IF D=2 THEN 300
220 NEXT G: IF D=3 THEN 300
230 NEXT F: IF D=4 THEN 300
240 NEXT E
300 ?“YOUR PROBABILITY IS ”;:PRINT USING
    “#.######”;T
310 GOTO 110
```

This program works. (Whew! I'm so proud!) It runs quite slowly if you have lots of sides on your dice. I imagine there are some programmers out there who can improve on my system, and I would appreciate hearing from them.

I seem to have left you with lots of dice that are hard to build. Can you imagine a one-sided die? Well, I can't either, but try it anyway because it will demonstrate something about probability. Remember the probability of the sure or certain event is always one. Moreover, these programs are not limited to dice games. If you have cards or balls or slips of paper numbered one through “N,” the outcome from one random draw is the same as throwing one die. If you return your draw, mix up the items and draw again; that is like throwing two “N” sided dice. Statisticians call this sampling with replacement because if you get a two on the first draw you can get a two on a later draw, also. In other words, items are not removed from the pool of possibilities when they are chosen. Next time I will discuss how you might write a program to determine the probabilities of some card games where the cards are dealt without replacement.

One last note about Las Vegas. From the perspective of classical statistics, the house will always win. Nevertheless, if you enjoy gambling you can consider it entertainment and enjoy your fling. I had a wonderful time playing the video Black Jack and Poker. The screen graphics were stunning

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and at $.25 the price was low enough for my entertainment budget. Remember something else: even unlikely events do happen. If the probability of winning is only 0.01 you can still win. Just don't try it too often!

(Ms. Nielsen has taught economics and statistics in several universities for the past 10 years.)

Listing 1:

```
100 CLS:INPUT"HOW MANY SIDES ON
THE DIE";N
110 P=1/N:PRINT"THE PROBABILITY
OF EACH NUMBER  FROM 1 TO";N;"IN
 ";P
120 FOR J=1 TO N:T=0:FOR K=1 TO
J: T=P+T:NEXT K
130 PRINT"PROBABILITY OF <=";J;"
IS ";
140 PRINT USING "#.#####";T:
150 PRINT#-2,"THE PROBABILITY OF
 <=";J;" = ";T:NEXT J
160 R$=INKEY$: IF R$="" THEN 160
170 GOTO 100
```

Listing 2:

```
100 CLS:INPUT"NUMBER OF SIDES";N
110 INPUT"NUMBER OF DIE (1-5)";D
120 P=1/(N^D)
140 INPUT"YOU WANT";L:T=0:E=0:F=
0:G=0:H=0:M=0
150 IFD>4 THEN FORE=1TON
160 IFD>3 THEN FORF=1TON
170 IFD>2 THEN FORG=1TON
180 IF D>1 THEN FORH=1TON
190 IFD=1THENT=P:GOTO300
195 FORM=1TON
200 Z=E+F+G+H+M
220 IFZ=L THEN T=T+P
240 NEXTM:NEXTH:IFD=2THEN300
250 NEXTG:IFD=3THEN300
260 NEXTF:IFD=4THEN300
270 NEXTE
300 PRINT"YOUR PROBABILITY IS ";
:PRINTUSING"#.######";T
320 GOTO120
```

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By Cary D. Perttunen

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Filmastr: A Handy Do-It-All Filing System For CoCo

One of the reasons that I bought a disk, aside from the inherent speed, was to enable me be explore more serious applications of my CoCo. Sure I like games, but it seemed to me to be a waste of computing power when all I was doing was eating "power dots," and protecting cities from being destroyed.

I took my first step in this direction when I bought a word processor. The next step I took was to write a program to keep track of my growing library of programs. After I wrote it, I started to think of other things that I wanted to keep track of. I did not want to have to write a new program for each application I could think of so I started to think about a "do-it-all" program. At about the same time I began to see ads for this type of program, so I figured that I would lay back and let someone else do the work for me.

Filmastr is just such a program. With it you can create and maintain just about any kind of file that you can think of. It features full screen editing of data, copying fields from one record to the next while adding information, machine language sorting, record selection, print formatting, and of course, adding, changing and deleting of the records in your file.

When the program is *RUN,* a title screen appears with a menu of two choices. You can either define a new file or load an existing one. Since you must define your file before you can do anything else with it I will discuss this first.

The first thing you do is to give your file a title (or name as I prefer to call it). You then define all of your fields and their lengths. While you are doing this the fields as well as the title can be placed almost anywhere on the screen. Also each field is assigned a number for future reference. I thought that this was a nice feature, because it allows you to determine exactly how the screen will look when you are using it later on.

Once your file is defined you are told how many fields it has, the length of the file and how many records it can hold. This definition is then saved, and you are ready to start working with your file.

In order to begin working with your file you must first load it. This may seem like the obvious thing to do, but it also applies to files that have just been defined that have no records in them yet. After your file is loaded, the bottom of the screen shows your choices at this point.

The first thing that you will be doing is to add some records to your file. This is done using the screen format that you defined previously. Entering data is done one field at a time, and you can use the arrow keys to correct any mistakes before you hit *ENTER.*

From this screen you can also load in another file. This requires that both files be defined in exactly the same manner, and allows you to merge several small files into a larger one. More on this later. This screen also has the Sort option, which will allow you to put your file into any sequence. You can sort on more than one field but you cannot sort in descending order. The other options here are to End the program, which will ask you if you have saved your file, and to List your file.

When listing your file, you can browse through it quickly on the screen using the arrow keys. If you hit the *BREAK* key, another menu is presented at the bottom of the screen. This menu has six additional options. From it you can change or delete records. These are pretty straightforward, so I won't go into them any further.

The Select option allows you to work with a subset of the file. Any field can be used in the selection. You can also use a portion of a field, as well as two relational operators. For example, you can select name equal to "S" for all names starting with the letter "S," or name equal to "PETERS" for all names of "PETERS," "PETERSON," or whatever. The relational operators can be used, for example, to select all Zip Codes greater than "20000."

The Save option allows you to save your file. The interesting thing here is that your file is saved based on the records that have been selected. If the Select option has not been used, then all the records are saved. However, if you have selected records, then only those selected will be saved. These smaller files can be used just like any other and can always be merged together, which provides a good amount of flexibility.

The Sum option allows you to add up any numeric field and will give you a total of the field. By combining this feature with the Select feature, you can get totals for any part of your file.

The Print option (you guessed it) will print your file to the screen or printer. In order to print a file you must define a "print format." This format tells the program which fields are to be printed, and in what order. You can also add spaces or whatever you like between the fields, and you can print the fields on several lines. An example of this would be if you wanted to print name and address labels. You would print the name and address on separate lines, the city followed by a comma and a space, the state followed by a space, and the Zip Code. Although this sounds very flexible, you cannot format numeric fields with embedded commas or periods, and you cannot produce listings with headings or page numbers—very basic features in my opinion. Also when listing to the screen, you will have to hit the shift and "@" keys to stop it from scrolling off the screen.

All things considered, *Filmastr* is a very good utility program. The documentation is very well written, and will guide the first time user through the various options with no problem. If you want to do some serious work with your CoCo, I recommend that you check it out.

(The Computer House, Box 1051, DuBois, PA 15801, $29.95 tape, $34.95 disk)

—Gerry Schechter

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Software Review

Alcatraz II Unsuccessful As Great Escape

Alcatraz II is a graphic escape game using low resolution graphics (*PMODE* 1). In your role as a convict, you frantically try to escape from the penitentiary, avoiding guards, robots and the trained killer, the Minotaur. After *CLOADing* the Extended BASIC program, you start the game by choosing to use either the four arrow keys or the right joystick.

You maneuver your figure through a maze of square cell blocks, hoping to find a clear escape path from the wing. The exit of each wing is located on the right side of the screen. There are also guards in the wing who constantly patrol the hallways. Your figure moves at the same speed as the guards, so there is no chance of being outrun. If a guard catches you, the escape is unsuccessful and the game is over. Between some of the blocks are closed gates. You cannot pass through the closed gates, but when a guard passes through a gate, he opens it, leaving you a way out. The key to the game is to lure the guards toward you. If a guard sees you in his hallway, he will move toward you, opening all gates in his way. If you take too much time in a wing, you should expect to see the hall lasers. After a short buzzing alarm, five lines slowly emerge down each hall, from either the right or top of the screen. You must quickly move to a safe hallway to avoid being zapped. Unfortunately, the lasers will close any previously opened gates. If you reach the exit of the wing, your score will be added up and displayed. After you escape each wing, the number of guards in each wing increases. You must get through two more identical wings before encountering the Minotaur.

In the fourth wing, you will see the Minotaur, two walls, and three force fields with their corresponding switchboxes. The Minotaur moves in random directions, but moves faster than you, so you have to react quickly. Once in the Minotaur's lair, you must deactivate the force fields by entering the switchboxes. You may hide from the Minotaur in the switchboxes because he is too large to enter. You cannot pass through a wall, but the Minotaur can, leaving a hole in the wall. Waiting for the Minotaur to destroy a particular segment in the wall can take a considerable length of time, a wait that is quite tedious.

After eluding the Minotaur, you must get through two more wings to complete the escape of the first building. The second and third buildings are identical to the first in structure, except for additional robot guards. The robot guards move slower than you, but they always move directly toward you, forcing you to make quicker decisions than before. You must take advantage of the robots' slower speed to avoid being captured. The great escape is over when you exit the third building.

On the opposite side of the tape of *Alcatraz II*, there is an instruction program. This program explains the important aspects of playing, and introduces you to the characters. Personally, I would rather read instructions on the screen than on paper any day. The instruction program also gives you hints on playing and automatically starts loading the main program. The documentation also explains the bug in ROM which may yield a SN error because of the *PCLEAR* statement. If this occurs, simply type *RUN* again and all should be well.

The movements of the figures are slow and choppy due to the limitations of Extended BASIC. The program also makes use of sound and keeps track of the high score.

Alcatraz II, I believe, does not compare with the high quality of some other games of this type for the Color Computer, but the price is not high, either.

(Spectral Associates, 3416 South 90th Street, Tacoma, WA 98409, $8.95 on tape)

—Joe Esposito

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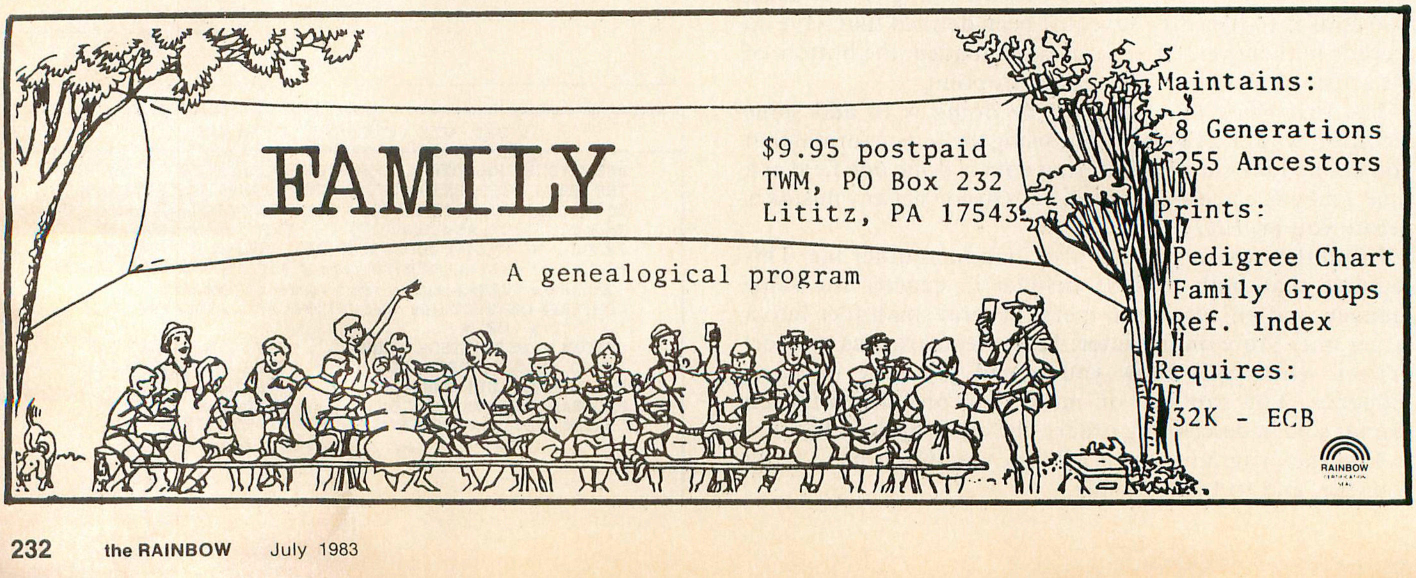
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Robottack: A Fast-Paced, High-Res Shoot 'em up

When *Robottack* arrived for review, the first thing that struck my mind was, "Oh no, not another clone of the famous *Beserk* game! Can't they think of anything new?" Well, I'm glad to say I was wrong (maybe even *dead* wrong).

Although there are robots and humans involved in this game, it does not incorporate the mazes and rooms of the well known arcade game. As a matter of fact, one of the neat features of this game is the ability to move freely all around the screen. You are the "super human" who must fight off the attacking robots and save the remaining humans from destruction. The left joystick is used to move your human anywhere on the screen, and the right one to shoot in any of eight directions. This takes a little getting used to at first, not only to coordinate the movement between the two joysticks, but to "untrain" yourself that the fire button shoots bullets. In this game, the fire button is used only to start playing.

As you successfully fend off the robots, you move to another "frame," and the action starts over again, only with more difficulty. I don't know how many frames there are, but after about 10 minutes of play, I progressed to frame 11 and achieved a score of 28,000 points. I'll spend a few hours trying to reach the heights of *Robottack* fame. There are plenty of obstacles to overcome, however, since there is not just one kind of robot, but guardian robots, gunner robots, mind robots, and bombs. The bombs look like "X's," and they chase after you very *very* fast.

The beginning of each new frame starts off with great audio/visual effects, as your super-human "materializes" in the center of the screen, similar to the famous Imagic game, *Demon Attack.* At the same time, your foes appear at various random points on the playfield, wasting no time as they start to seek you out. Each new frame brings more vicious robots and faster action. I've discovered that it's not necessary to clear each new frame entirely of robots, which leads me to believe that new playfields are achieved by reaching certain point levels.

Although many games claim to be (and indeed are) in machine language, that doesn't necessarily mean that they're done well. All too often, the sound effects suffer for the graphics, or vice versa. Intracolor did a good job with this one, taking full advantage of the Color Computer's sound and graphics abilities. It is a fast-paced, high-resolution, arcade style shoot 'em up, and for those of you who like that kind of thing, this is a good bet. It's designed for one or two players, with the top five scores displayed on the screen.

They were thoughtful enough to include a PAUSE feature which you activate by pressing the space bar. But my game has paused long enough—it's time to get to frame 12.

(Intracolor Communications, P.O. Box 1035, East Lansing, MI 48823, $24.95 cassette, $27.95 disk)

—Bob Safir

New *Frog* Is A Prince Of A Program

Tom Mix Software has done it again! Their newest addition to the company's list of software is *The Frog.*

The Frog is an almost flawless derivative of *Frogger.* Everything in *Frogger* is here in *The Frog.* There are lady frogs, treacherous diving turtles, pesky flies, hungry alligators and deadly snakes to contend with.

In case any of you out there have not seen *Frogger* or *The Frog*, here is a description of how the game works. The object is for you, the frog, to travel from the bottom of the screen to the top and safety. Sound easy? Not quite.

There are cars, trucks and other vehicles that would love to run your green body into the pavement. There are about five rows of this before you reach the middle of the screen—if you live that long. Here is a safe place from the cars, but, on screen three, a snake moves back and forth when you reach this spot and would like frog legs for dinner.

Ahead of you are another five rows of water and numerous logs and turtles move back and forth in different directions at varying speeds. Unfortunately, *your frog can't swim* and getting your feet wet is fatal. Now we jump on a group of turtles and wait there. Oh no, their backs are only showing now; better get off before they submerge and we get all wet. So we quickly jump onto a passing log.

What do we have here? A girl frog! Like a lady or gentleman you'll help her get across the river, for an extra 200 points. Now we jump on another faster log and—what's this?—a snapping alligator is moving towards us! Don't jump into gator's jaw or we will be someone's lunch. We'll jump on his back.

Now we slowly move along watching the clock in order not to run out of time. Here comes a home safe spot, our destination. Before we jump, a fly appears in that spot, so now, instead of being eaten, let's eat the fly and get 200 extra points. We must do that five more times before we go to another screen and a harder challenge.

The detail of this game is amazing. Some of the cars have exhaust coming out of them as they move. The logs roll. The turtle's legs move. When turtles dive there are bubbles. The fly flaps his wings. The gator's jaws and tail move and, when you are killed, a skull and crossbones appear over the spot. *The Frog* uses the highest graphics mode and is written in machine language.

The Frog, fortunately, takes the middle ground in difficulty. It is not too hard as to be impossible, but not too easy as to be boring, and after some practice you can actually get good.

(Tom Mix Software, 3424 College N.E., Grand Rapids, MI 49505, $27.95 on tape, $30.95 on disk)

—Jeff White

RAINBUG III

Part three of a series on our new machine language monitor being developed by the author, *Rainbow* Technical Editor, Dan Downard

In last month's installment we added a section of machine code to the *Rainbug* monitor showing how to calculate offsets and mentioned the different types of addressing used in a 6809 microprocessor. This month we will add the facility of calculation of postbytes, such as those used in indexed and indirect addressing of *Rainbug* and discuss the different types of instructions understood by the machine. If you are having trouble inputting the machine code into your CoCo look in this issue under "Rainbow Info" for a quick BASIC program for inputting machine language routines. Remember the starting address for *Rainbug* is $3000 in the listing, but it can be changed to any address you desire. Until you are sure it is functioning properly it is best to leave it at $3000.

6809 Instructions

Machine code instructions can be divided into five major categories according to the affected registers:

Instructions	**Register(s)**
•8-Bit Accumulator and Memory Instructions	A,B
•16-Bit Accumulator and Memory Instructions	D
•Index/Stack Pointer Instructions	X,Y,U,S
•Branch Instructions	CC
•Miscellaneous Instructions	All

For your reference we are including a list of all instructions in Table 1 through 5. By looking at the mnemonics and the description following them you can follow assembly texts in any article as they are used exclusively with the addressing modes discussed in last months segment to describe all of the available machine code functions. We will examine an instruction from each set to familiarize us with the procedure.

8-Bit Accumulator and Memory Instructions

For our example let's look at the ADDA instruction, or add memory to accumulator A. This particular instruction is also valid for the B register, thus the notation ADDB. It can be used with all but inherent addressing modes since the value of any memory location is added to the A register and the a register is replaced with this value. Certain bits of the CC (Condition Code) register are affected by this operation and for anything but simple binary arithmetic must be examined for future operations.

16-Bit Accumulator and Memory Instructions

The STD instruction stores the 16-bit value in the D register, which is the A and B registers combined, at any memory location depending on the addressing method in use. How can you store a 16-Bit value at one 8-Bit memory location? You can't. The 16-Bit value is actually stored at the memory address specified and the next consecutive byte. Again, the inherent mode is the only type of addressing that can't be used.

Index/Stack Pointer Instructions

What happens when you want to store a value for future reference such as a return address for a subroutine. The microprocessor does this automatically when you execute certain instructions through the use of the S, or Stack Pointer register. In reality, this is a memory location in RAM whose location is recognized by the 6809 through your instruction such as LEAS. If you notice from Table 3 there are actually two stacks, the S and U registers. The S register is always

---

(Dan Downard is an electrical engineer and has been involved in electronics for 24 years through ham radio (K4KWT). His interest in computers began about five years ago and he has built several 68XX systems.)

recognized by the microprocessor as the primary, or hardware, stack. Any register can be temporarily saved for future use by instructions such as PSHS or retrieved by the PULS. What these instructions do is provide a method of organization for logical temporary storage of variables and addresses.

Table 1
8-Bit Accumulator and Memory Instructions

Instruction	Description
ADCA, ADCB	Add memory to accumulator with carry
ADDA, ADDB	Add memory to accumulator
ANDA, ANDB	And memory with accumulator
ASL, ASLA, ASLB	Arithmetic shift of accumulator or memory left
ASR, ASRA, ASRB	Arithmetic shift of accumulator or memory right
BITA, BITB	Bit test memory with accumulator
CLR, CLRA, CLRB	Clear accumulator or memory location
CMPA, CMPB	Compare memory from accumulator
COM, COMA, COMB	Complement accumulator or memory location
DAA	Decimal adjust A accumulator
DEC, DECA, DECB	Decrement accumulator or memory location
EORA, EORB	Exclusive or memory with accumulator
EXG R1, R2	Exchange R1 with R2 (R1, R2=A, B, CC, DP)
INC, INCA, INCB	Increment accumulator or memory location
LDA, LDB	Load accumulator from memory
LSL, LSLA, LSLB	Logical shift left accumulator or memory location
LSR, LSRA, LSRB	Logical shift right accumulator or memory location
MUL	Unsigned multiply (A × B → D)
NEG, NEGA, NEGB	Negate accumulator or memory
ORA, ORB	Or memory with accumulator
ROL, ROLA, ROLB	Rotate accumulator or memory left
ROR, RORA, RORB	Rotate accumulator or memory right
SBCA, SBCB	Subtract memory from accumulator with borrow
STA, STB	Store accumulator to memroy
SUBA, SUBB	Subtract memory from accumulator
TST, TSTA, TSTB	Test accumulator or memory location
TFR R1, R2	Transfer R1 to R2 (R1, R2=A, B, CC, DP)

NOTE:
A, B, CC, or DP may be pushed to (pulled from) either stack with PSHS, PSHU (PULS, PULU) instructions.

Branch Instructions

Remember the offset calculator from last month's article? Offsets are used in conjunction with branch instructions to compare values in a program requiring a decision on how to proceed. I suppose a simple program is the best way to illustrate. Using the memory examine function of *Rainbug*, enter the following program into memory starting at $2000.

```
$2000    8E A147    LDX     #$A147
$2003    A6 80      LDA     ,X+
$2005    BD A30A    JSR     $A30A
$2008    8C A16F    CMPX    #$A16F
$200B    26 F6      BNE     $2003
$200D    39         RTS
```

This particular program should tell you what version of ROM you have in your computer. Notice that the routine printed the value of memory at the location of the X register and compared it each time with $A16F. If it was not equal, another character was printed.

Miscellaneous Instructions

This group of instructions is a grab bag of commands that are not directly related to any specific register. For example the JMP instruction tells the 6809 to change the value of the program counter, thereby moving program execution to a different address. Essentially when you execute an *EXEC* instruction in BASIC you are doing the same thing. Did you notice the interrupt instructions? We will cover interrupts and condition codes next month.

Table 2
16-Bit Accumulator and Memory Instructions

Instruction	Description
ADDD	Add memory to D accumulator
CMPD	Compare memory from D accumulator
EXG D, R	Exchange D with X, Y, S, U, or PC
LDD	Load D accumulator from memory
SEX	Sign Extend B accumulator into A accumulator
STD	Store D accumulator to memory
SUBD	Subtract memory from D accumulator
TFR D, R	Transfer D to X, Y, S, U, or PC
TFR R, D	Transfer X, Y, S, U, or PC to D

NOTE:
D may be pushed (pulled) to either stack with PSHS, PSHU (PULS, PULU) instructions.

Rainbug

Two new commands are added to *Rainbug* this month. One was actually in the listing last month but omitted from the commands.

X   Exit to BASIC
E   Encode Postbyte

The X command is self explanitory and executes as soon as the key is depressed, so be careful. If hit by accident an *EXEC* command from BASIC will return you to *Rainbug*. The E command has the following syntax:

```
E ,X++
E HHHH,PCR
E H,X
```

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The preceding examples are all mnemonics requiring a postbyte as part of the op-code. The E command will automatically calculate the postbyte for you. The letter "H" is input to indicate the number of hex bytes needed in the expression.

Table 3
Index/Stack Pointer Instructions

Instruction	Description
CMPS, CMPU	Compare memory from stack pointer
CMPX, CMPY	Compare memory from index register
EXG R1, R2	Exchange D, X, Y, S, U or PC with D, X, Y, S, U or PC
LEAS, LEAU	Load effective address into stack pointer
LEAX, LEAY	Load effective address into index register
LDS, LDU	Load stack pointer from memory
LDX, LDY	Load index register from memory
PSHS	Push A, B, CC, DP, D, X, Y, U, or PC onto hardware stack
PSHU	Push A, B, CC, DP, D, X, Y, X, or PC onto user stack
PULS	Pull A, B, CC, DP, D, X, Y, U, or PC from hardware stack
PULU	Pull A, B, CC, DP, D, X, Y, S, or PC from hardware stack
STS, STU	Store stack pointer to memory
STX, STY	Store index register to memory
TFR R1, R2	Transfer D, X, Y, S, U, or PC to D, X, Y, S, U, or PC
ABX	Add B accumulator to X (unsigned)

Summary

It looks like this four-part series is going to be extended another month out of necessity to cover all of the material intended in short, hopefully digestible, segments. Next month we will cover interrupts and the CC register. We will add tape and disk commands to *Rainbug* leaving breakpoints for last. So far the starting, ending and execute addresses are $3000, $3302, $319E. Notice that the lookup table is different due to addition of a new command. See you next month!

Table 4
Branch Instructions

Instruction	Description
	SIMPLE BRANCHES
BEQ, LBEQ	Branch if equal
BNE, LBNE	Branch if not equal
BMI, LBMI	Branch if minus
BPL, LBPL	Branch if plus
BCS, LBCS	Branch if carry set
BCC, LBCC	Branch if carry clear
BVS, LBVS	Branch if overflow set
BVC, LBVC	Branch if overflow clear
	SIGNED BRANCHES
BGT, LBGT	Branch if greater (signed)
BVS, LBVS	Branch if invalid twos complement result
BGE, LBGE	Branch if greater than or equal (signed)
BEQ, LBEQ	Branch if equal
BNE, LBNE	Branch if not equal
BLE, LBLE	Branch if less than or equal (signed)
BVC, LBVC	Branch if valid twos complement result
BLT, LBLT	Branch if less than (signed)
	UNSIGNED BRANCHES
BHI, LBHI	Branch if higher (unsigned)
BCC, LBCC	Branch if higher or same (unsigned)
BHS, LBHS	Branch if higher or same (unsigned)
BEQ, LBEQ	Branch if equal
BNE, LBNE	Branch if not equal
BLS, LBLS	Branch if lower or same (unsigned)
BCS, LBCS	Branch if lower (unsigned)
BLO, LBLO	Branch if lower (unsigned)
	OTHER BRANCHES
BSR, LBSR	Branch to subroutine
BRA, LBRA	Branch always
BRN, LBRN	Branch never

Table 5
Miscellaneous Instructions

Instruction	Description
ANDCC	AND condition code register
CWAI	AND condition code register, then wait for interrupt
NOP	No operation
ORCC	OR condition code register
JMP	Jump
JSR	Jump to subroutine
RTI	Return from interrupt
RTS	Return from subroutine
SWI, SWI2, SWI3	Software interrupt (absolute indirect)
SYNC	Synchronize with interrupt line

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```
                 00100 *RAINBUG
                 00110 *DAN DOWNARD      REV 2
                 00111 *LINES 100-2550 AND LINES
                 00112 *2885-3080 APPEARED IN PARTS
                 00113 *1 AND 2 OF THIS SERIES
3000             00120          ORG     $3000
         31A8    00130 CMDBAD   EQU     ERROR
         008C    00140 SKIP2    EQU     $8C
         A000    00150 POLCAT   EQU     $A000
         A002    00160 CHROUT   EQU     $A002
                 02555 *TABLE OF COMMANDS
         3205    02560 CMDTBL   EQU     *
3205     42      02570          FCC     /B/
3206     00F2    02580          FDB     BKPT-*
3208     43      02590          FCC     /C/
3209     00F0    02600          FDB     CALL-*
320B     44      02610          FCC     /D/
320C     00EE    02620          FDB     DISK-*
320E     45      02630          FCC     /E/
320F     0054    02640          FDB     ENCDE-*
3211     47      02650          FCC     /G/
3212     00E9    02660          FDB     GO-*
3214     4C      02670          FCC     /L/
3215     00E7    02680          FDB     LOAD-*
3217     4D      02690          FCC     /M/
3218     FDE8    02700          FDB     CMEM-*
321A     40      02710          FCC     /@/
321B     00E2    02720          FDB     PRINT-*
321D     4F      02730          FCC     /O/
321E     0017    02740          FDB     OFFS-*
3220     50      02750          FCC     /P/
3221     00DD    02760          FDB     PUNCH-*
3223     52      02770          FCC     /R/
3224     00DB    02780          FDB     REG-*
3226     53      02790          FCC     /S/
3227     00D9    02800          FDB     STLEV-*
3229     54      02810          FCC     /T/
322A     00D7    02820          FDB     TRACE-*
322C     56      02830          FCC     /V/
322D     00D5    02840          FDB     VER-*
322F     57      02850          FCC     /W/
3230     FE5C    02860          FDB     CWINDO-*
3232     58      02870          FCC     /X/
3233     002A    02880          FDB     EXIT-*
                 03085 *ENCODE A POSTBYTE
3263 6F  E2      03090 ENCDE    CLR     ,-S
```

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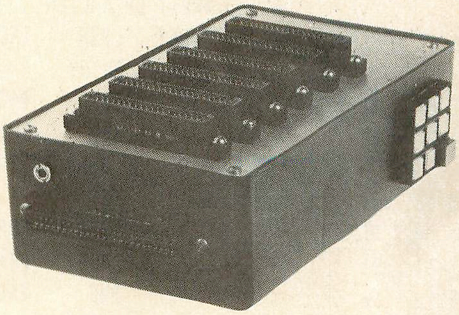
SHIFT



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```
3265 5F             03100           CLRB
3266 30    8D 0048  03110           LEAX   CONV1,PCR
326A 17    FF01     03120           LBSR   INCH
326D 81    5B       03130           CMPA   #$5B
326F 26    07       03140           BNE    EN2
3271 86    10       03150           LDA    #$10
3273 A7    E4       03160           STA    ,S
                    03165 *NEXT CHARACTER
3275 17    FEF6     03170 ENGET     LBSR   INCH
                    03175 *END OF ENTRY
3278 81    0D       03180 EN2       CMPA   #$0D
327A 27    0E       03190           BEQ    END1
                    03195 *LOOK UP CHAR IN TABLE
327C 6D    84       03200 ENLP1     TST    ,X
327E 1027  FF26     03210           LBEQ   ERROR
3282 A1    81       03220           CMPA   ,X++
3284 26    F6       03230           BNE    ENLP1
3286 EB    1F       03240           ADDB   -1,X
3288 20    EB       03250           BRA    ENGET
328A 30    8D 004D  03260 END1      LEAX   CONV2,PCR
328E 1F    98       03270           TFR    B,A
3290 84    60       03280           ANDA   #$60
3292 AA    E4       03290           ORA    ,S
3294 A7    E4       03300           STA    ,S
3296 C4    9F       03310           ANDB   #$9F
3298 6D    84       03320 ENLP2     TST    ,X
329A 1027  FF0A     03330           LBEQ   ERROR
329E E1    81       03340           CMPB   ,X++
32A0 26    F6       03350           BNE    ENLP2
32A2 E6    1F       03360           LDB    -1,X
32A4 EA    E4       03370           ORB    ,S
32A6 E7    E4       03380           STB    ,S
32A8 30    E4       03390           LEAX   ,S
                    03395 *PUT CHAR ON SCREEN
32AA 17    FEBB     03400           LBSR   OUT2HS
32AD 17    FED3     03410           LBSR   PCRLF
32B0 35    84       03420           PULS   PC,B
                    03425 *TABLE OF VALID INPUTS
32B2       41       03430 CONV1     FCC    /A/
32B3       04       03440           FCB    $04
32B4       42       03450           FCC    /B/
32B5       05       03460           FCB    $05
32B6       44       03470           FCC    /D/
32B7       06       03480           FCB    $06
32B8       48       03490           FCC    /H/
32B9       01       03500           FCB    $01
32BA       48       03510           FCC    /H/
32BB       01       03520           FCB    $01
32BC       48       03530           FCC    /H/
32BD       01       03540           FCB    $01
32BE       48       03550           FCC    /H/
32BF       00       03560           FCB    $00
32C0       2C       03570           FCC    /,/
32C1       00       03580           FCB    $00
32C2       2D       03590           FCC    /-/
32C3       09       03600           FCB    $09
```

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```
32C4    2D      03610           FCC     /-/
32C5    01      03620           FCB     $01
32C6    53      03630           FCC     /S/
32C7    70      03640           FCB     $70
32C8    59      03650           FCC     /Y/
32C9    30      03660           FCB     $30
32CA    55      03680           FCC     /U/
32CB    50      03690           FCB     $50
32CC    58      03700           FCC     /X/
32CD    10      03710           FCB     $10
32CE    2B      03720           FCC     /+/
32CF    07      03730           FCB     $07
32D0    2B      03740           FCC     /+/
32D1    01      03750           FCB     $01
32D2    50      03760           FCC     /P/
32D3    80      03770           FCB     $80
32D4    43      03780           FCC     /C/
32D5    00      03790           FCB     $00
32D6    52      03800           FCC     /R/
32D7    00      03810           FCB     $00
32D8    5D      03820           FCC     /]/
32D9    00      03830           FCB     $00
32DA    FF      03840           FCB     $FF
                03845 *CONVERSION TO SET POSTBYTE
32DB    1084    03850 CONV2     FDB     $1084
32DD    1100    03860           FDB     $1100
32DF    1288    03870           FDB     $1288
32E1    1389    03880           FDB     $1389
32E3    1486    03890           FDB     $1486
32E5    1585    03900           FDB     $1585
32E7    168B    03910           FDB     $168B
32E9    1780    03920           FDB     $1780
32EB    1881    03930           FDB     $1881
32ED    1982    03940           FDB     $1982
32EF    1A83    03950           FDB     $1A83
32F1    828C    03960           FDB     $828C
32F3    838D    03970           FDB     $838D
32F5    039F    03980           FDB     $039F
32F7    00      03990           FCB     $00
                03995 *RETURNS FOR FUTURE ROUTINES
32F8 39         04000 BKPT      RTS
32F9 39         04010 CALL      RTS
32FA 39         04020 DISK      RTS
32FB 39         04030 GO        RTS
32FC 39         04040 LOAD      RTS
32FD 39         04050 PRINT     RTS
32FE 39         04060 PUNCH     RTS
32FF 39         04070 REG       RTS
3300 39         04080 STLEV     RTS
3301 39         04090 TRACE     RTS
3302 39         04100 VER       RTS
        0000    04110           END
00000 TOTAL ERRORS
```

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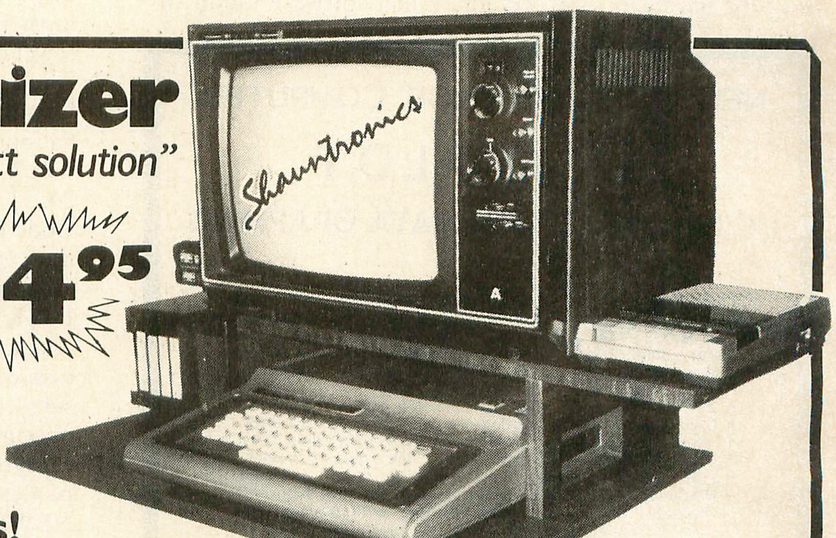

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A Tale of Three Flexes

By Dr. Laurence D. Preble

All in favor of more powerful software for the Color Computer say Aye! Good . . . Now, someone explain to the Russian ambassador that rumble he heard was not a nuclear test—only the unanimous agreement of a megaton of CoCo users.

If you have been following my periodic reviews, you know that Flex (TM of Technical Systems Consultants) is a powerful alternative disk operating system for the Color Computer. An incredible variety of business software is designed to run under Flex. A number of programming languages are available including Pascal, Fortran, RS BASIC, RS Assembler, TSC BASIC, TSC Assembler, Relocating Assembler, Macro Assembler, Mumps, Forth and "C." Another reason I use Flex with the Color Computer is that it allows me to run high performance disk drives as well as the standard Radio Shack drives. One drive I use can handle nearly a megabyte of storage; that translates to over 200 programs stored on one disk!

Data-Comp was the first to "have" Flex for the Color Computer about two years ago. Commercial distribution did not actually begin until 1982. Their current offering has evolved considerably since the early beginnings which required hardware adapters and much software modification. Frank Hogg Labs began offering their commercial version in early 1982. This implementation was actually the first to run on an "almost" stock CoCo. I say almost because it still required the hardware addition of 64K chips as do all current versions of Flex. Brand new is the offering by Spectral Associates. If each version of Flex were totally identical with its companions, it would not matter much where you purchase Flex. Life is rarely that simple. Technical Systems Consultants (TSC) authored the original versions of Flex; those versions, however, will not run on the Color Computer without modification. It is the modifications to Flex that are unique to each distributor.

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Modifications to Flex consist of special input/output routines, video display implementations, printer drivers and disk drivers. Methods of installing Flex in the CoCo vary as well. In addition, each distributor has provided certain added attractions which we will discuss in some detail.

Data-Comp Flex

Data-Comp does not actually sell a fully modified version of Flex—what they do sell is the F-MATE(RS) conversion for TSC Flex. The user, however, may purchase both the F-MATE(RS) conversion and TSC General version of Flex from the people at Data-Comp; it is then, a relatively simple procedure to combine the conversion package with Flex to have a working system. Once a "boot up" disk has been created, you can enter Flex from Radio Shack Disk BASIC by typing RUN "FLEX."

Once you have entered Flex, you may select a high resolution video display; you are no longer limited to the standard Radio Shack 32 column by 16 row screen format. A 51 x 24 display format is most useful; it provides good legibility on most TVs while giving you the added features of upper and lower case characters and an XY addressable cursor. Inverse video is also available. One very nice extra is that Data-Comp provides you with the Assembly Language Source listings of the video routines so that you may modify them at will. You may create screen formats of 32 x 16, 32 x 24, 42 x 24, 51 x 24 and 64 x 24. (Data-Comp also provides Source Code for a total of eight of its support commands, a freebie not currently available from other companies.)

Another salient feature of Data-Comp Flex is its NEWDISK command. NEWDISK allows you to format a new disk any way you like within the physical limitations of the disk drive you are using. You may specify double or single sided, double or single density and you may specify the maximum number of tracks available. Up to this point, everything I have mentioned is also true of the other companies' NEWDISK commands; however, Data-Comp's NEWDISK also provides you with a running commentary on how the formatting is proceeding. Formatting a megabyte disk on a high performance drive takes several minutes and may lead you to believe your system has "hung" or crashed; so it is very nice to visualize the progress being made.

Although it is fine to use a Radio Shack disk drive with Flex, the formats of a Flex diskette and a Radio Shack diskette are dissimilar and therefore incompatible; however, Data-Comp provides three utilities for exchange of information between Radio Shack and Flex diskettes. RSREAD is a machine language command which will read a file from a Radio Shack disk and transfer the information to a Flex disk. This function is provided free. RSDIR is a machine language command which displays the directory of a Radio Shack disk—also free. Frank Hogg Labs does provide a command which includes the functions of RSREAD and

RSDIR but Hogg's version is written in DBASIC which you must purchase separately. Spectral Associates does not currently provide a similar function. RSWRITE is a machine language command which will write a Flex file to a Radio Shack disk. Currently, neither Frank Hogg Labs nor Spectral Associates offers such a function. Finally, RSCVBIN is a machine language command which will *rearrange* the format of a Radio Shack machine language program so that it will run under Flex. No other company currently offers this function.

Also provided free is CCBASIC, a conversion for Radio Shack Extended BASIC to run under Flex. The conversion allows you to *LOAD* and *SAVE* both BASIC and machine language programs in Flex format. Special disk input/output routines such as individual sector read/write functions are not implemented.

Data-Comp provides an unusual printer driver command that checks to see if the printer is ready before outputting data. Without such a feature, your system will "hang up" and need to be reset if you attempt to send data to the printer port with no printer available.

MEMEX and DISKEX are two more interesting machine language commands which allow the user to examine and change memory or the sectors of a disk respectively.

DISKRATE allows the user to set the stepping rate of a DISK drive. This is useful because some high performance drives can step up to five times faster than normal Radio Shack drives.

USERKEYS provides a means of defining your own control codes and special characters not available on the normal Color Computer keyboard.

When you buy the Flex package from Data-Comp, they also include a full feature Editor and Assembler from TSC. This is not exactly a freebie, however, because Data-Comp's price for their Flex package is higher than either the Frank Hogg Laboratories or the Spectral Associates version.

For those of you who wish to purchase or already own a separate terminal, Data-Comp sells a handy utility called TERM. For $19.95 you receive a package that allows another terminal to access the Color Computer. An interesting feature is the recognition of the BREAK key on the terminal. While using EXT and receiving output from the computer, you may press BREAK on the terminal which will cause the output to pause. You may then press ESC to continue output or press a carriage return to abort output. One truly unique feature of TERM is the automatic recognition of baud rates from the terminal.

Overall, I was impressed with Data-Comp's version of Flex. There were a few aspects I felt were lacking or could stand some improvement. One example which really stands out is that the people at Data-Comp never purchased a license for Flex from TSC. Both Frank Hogg Labs and Spectral Associates purchased the rights to distribute Flex at a cost of from $12,000 to $20,000. A license to Flex allows the distributor to freely modify the operating system and to distribute the end result at whatever price they choose. By not purchasing a license to Flex, Data-Comp must sell their package of modifications separate from Flex and devise a method for the user to combine the modifications with the Flex package. This is not so bad but does add an extra step to setting up Flex. To reiterate, anybody, including you or I, can sell TSC Flex; of course, TSC will receive most of the

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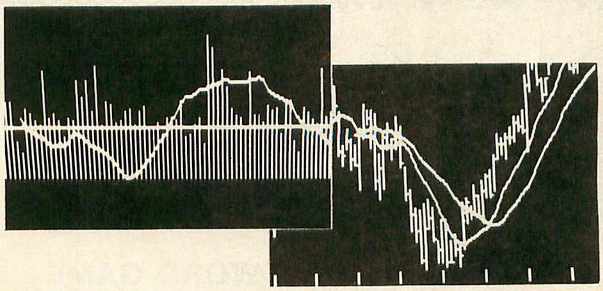

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profit unless we agree to pay X amount of dollars to license the product. Once we obtain the license, we owe TSC nothing more and can modify and distribute Flex at will.

Without a license, the problem is that the price of Flex is set by TSC. Theoretically at least, both Spectral Associates and Frank Hogg Labs could cut prices on their versions of Flex as low as they like becaue the *own* the rights to Flex and pay no further royalties on each sale. In practice, however, the prices of the three Flex versions are fairly competitive.

Frank Hogg Labs Flex

Frank Hogg Labs has been supplying Flex for the Color Computer for over a year now but has been supplying business software to run under Flex since 1979, long before the Color Computer was invented. The FHL version of Flex is well done. Installation of Flex is very simple because you do not need to do any procedures to modify Flex. Insert the system disk provided into drive 0 and type RUN "FLEX."

FHL Flex also privdes several high resolution screens such as 32 x 24, 51 x 24, 64 x 24 and even 64 x 32. Again, I find the 51 x 24 screen most useful in all versions of Flex as it provides the best compromise between legibility and density of information. The FHL video formats provide all of the expected features plus a few unique features. Like Data-Comp and Spectral Associates, FHL gives you an addressable cursor, upper and lower case, control codes and inverse video. Extra functions include an optional status bar at the bottom or top of the screen like the fancy professional terminals. It is also possible to "protect" certain portions of the screen. That is, you can put a block of information on the screen and keep it from scrolling or being overwritten. FHL video routines also allow special methods of generating *all* of the ASCII characters and codes without the necessity of defining user keys.

A very handy feature of FHL Flex is the HELP command. Did you forget how to work a certain command like CAT? Type HELP CAT to get the answer. No other version of Flex currently offers this feature.

FHL also provides a printer driver that is built into Flex. That means the driver is immediately available without loading from disk. You can even send a special control code form the keyboard to cause everything that outputs to the screen to also output to the printer. This is especially useful for getting hard copies from programs that were not designed to access the printer port. Baud rates up to 9600 are provided.

The SETUP command is very powerful. You may use SETUP to alter the printer baud rates, set up parameters for an external terminal, set up stepping rates for your disk drives and examine and change portions of memory. You can even use the SETUP command to tell the operating system what kind of disks you have; once the system is informed that you have a 40 track single sided drive, it would not waste time trying to format that drive 80 track or double sided. FHL's competitors at Data-Comp seem to feel that this aspect of SETUP is a waste of time and an extra step. On other Flex systems, if you attempt to operate a disk drive beyond its capacity it will flop around for a while but eventually give up. On FHL Flex the system immediately knows if you try to overextend a drive's capability and aborts gracefully. Is the extra step of using SETUP worthwhile? Well, before deciding, remember that this only need be done once and then forgotten. The other mentioned functions of SETUP are undisputably worthwhile.

For those who own or intend to buy a professional dumb terminal, a useful set of commands is EXT and INT. Like Data-Comp's TERM command, EXT gives control of the computer to an external terminal which would normally include a professional full function keyboard and an 80 x 24 character display. INT restores control to the Color Computer's internal keyboard. As with Data-Comp's TERM command, the BREAK key is recognized to cause a pause in the output stream. Unlike Data-Comp's TERM command, baud rates to the terminal are initialized with the SETUP command. Also unlike Data-Comp's TERM command, EXT and INT are included in the purchase price of FHL Flex.

Some of you may be interested in learning Assembly Language and may need some editing capability but are not willing to spend a hundred bucks for the software. Frank Hogg Labs recently began including an Interactive Assembler and a Tiny Editor free when you purchase their version of Flex for $69.95. I know that Data-Comp includes a full feature Assembler and Editor with their Flex. The catch is that Data-Comp charges $199 for their basic Flex package. Neither the Interactive Assembler (ISM) nor the Tiny Editor (TED) are as powerful as their grownup counterparts but they are surprisingly capable for their size. ISM assembles code directly to memory and can immediately execute the code, hence the term "Interactive." Also included is the ability to examine and change memory. TED is line oriented and allows global searches and changes.

So far, everything I have described is included when you buy FHL Flex for $69.95. For an extra $30, you can buy DBASIC which I feel is well worth the expense. DBASIC is FHL's conversion of Radio Shack's Disk Extended BASIC.

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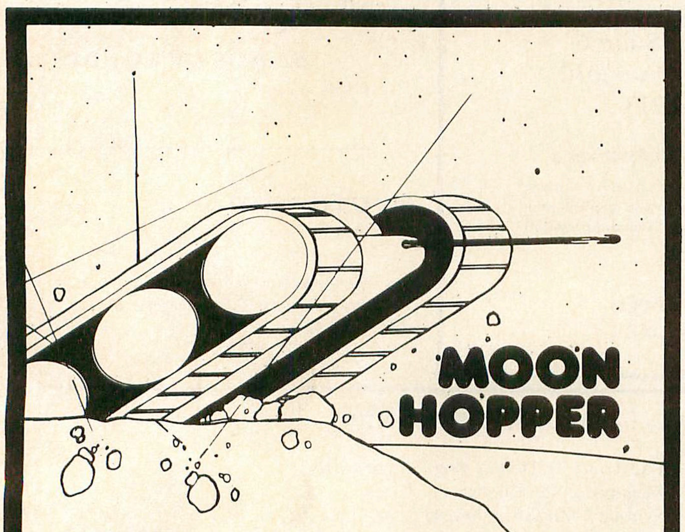
Nearly all the disk commands have been adapted to work with Flex. Implemented disk commands include FREE, DRIVE, VERIFY, LOC, LOF, DSKI$, DSKO$, OPEN and CLOSE. Only random files have not been implemented. Nearly all of my disk oriented RS BASIC programs will now run under DBASIC. This is different from Data-Comp's CCBASIC which will allow you to *LOAD* and *SAVE* programs in Flex but does not implement the other disk I/O commands. Of course, you must pay extra for DBASIC while CCBASIC is included in Data-Comp's basic Flex package.

I am happy with most features of FHL Flex. Like most of man's endeavors, there is room for improvement. Of the three Flex implementations tested, FHL had the slowest video display. Balance this statement with the knowledge that FHL's video display offered the most features. No Source Code was provided with the FHL utilities. This is unfortunate for the hackers like myself who are always tinkering and modifying their systems.

FHL copy protects their programs that puts the bootstrap loader (PUTBOOT) on a disk. A bootstrap loader is the program that gets you from Radio Shack Disk BASIC into Flex. Copy protection of the loader prevents the user from making illicit copies to distribute to friends. Unfortunately, it also prevents the user from making a backup copy of the bootstrap program for himself. This is not exactly terrible since the program which puts the bootstrap loader on a disk need only be used once. If PUTBOOT is ever destroyed FHL will send you another copy at a nominal fee. But this could be inconvenient. Understand that only the PUTBOOT command is protected—everything else that comes with FHL Flex may be copied for your personal use. Neither Data-Comp nor Spectral Associates protects their bootstrap loader.



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Spectral Associates Flex

Spectral Associates is the newest company to offer Flex but their effort is of high quality. Actually, Spectral Associates offers two versions of Flex, *Flexplus* for $69.95 and *Flexplus with Supercharger* for $89.95. The essential difference is that the addition of the Supercharger allows interrupt driven software to work without modification. For you technical types, the Supercharger moves the interrupt vectors out of ROM into high RAM. The Supercharger itself is a small printed circuit board which plugs directly into CoCo's expansion slot. The disk drives then plug into the Supercharger. One immediate advantage is the printer spooling capability provided with Supercharger Flex. Printer spooling is a form of multitasking or timesharing. The contents of a disk file are dumped to a printer as a background task. Simultaneously, you can use the computer for any other task such as editing, assembling, or TSC BASIC. Printer spooling also allows you to make multiple copies of any file or to output multiple files to the line printer. Anytime you wish to check on the progress of the printing, the QCHECK command will give you an update.

Installation of Flex+ is easy. Just insert the system disk provided and type RUN "FLEX+." Like Frank Hogg Labs, Spectral Associates has licensed the rights to Flex.

An outstanding feature of Spectral Associates' Flex (SAF) is the video display. The SAF video display was the fastest of the three tested. The HIRES video display was also the easiest to read with the color on my TV turned on. SAF's black on green format is more legible than FHL's and Data-Comp's black on white. I tried this on several TVs to make certain this was not an anomaly. However, if you are willing to turn off the color on your TV, all three companies' video formats are quite legible. Another interesting feature is that SAF's video formats are memory resident. You can instantly change from LORES to HIRES without waiting for disk I/O. Perhaps the most amazing fact is that none of SAF's video routines steal user memory. The entire bottom 48K is available for user applications. In both FHL and Data-Comp Flex, some user memory is required for the high resolution screens. SAF's video routines also allow addressable cursor and can generate control codes and special characters from the keyboard. SAF only provides a 32 x 16 and a 51 x 24 screen format, however. Since the 51 x 24 format is the most useful, I feel that most users will not miss the other high resolution formats.

SAF provides a selection of printer drivers. One driver optimizes the output for the Epson printer. Another driver optimizes the output for the Lineprinter VII. Baud rates are offered up to 9600 by careful timing sequences built into the drivers. All TTYSET parameters are honored.

One of SAF's most powerful commands is DUPO. For those of you who only own one disk, DUPO offers incredible control over making single disk copies. Individual files may be copied, the entire disk may be copied, or the directory will be scanned and the user will indicate which files to copy. This is a great enhancement over the single disk copy (SDC) commands offered by both FHL and Data-Comp. Other single disk copy commands require the user to specify each file individually.

MON is another memory resident command. (It is memory resident in the area where the HIRES screen resides and is available so long as you do not use the HIRES function). MON allows you to examine and change memory and jump to various execution points. I don't know how Spectral Associates managed to pack this and all the video routines into memory, but they did!

SAF offers another unique command, PLAY. PLAY loads and executes a machine language program which requires Radio Shack BASIC. As an example, SAF has included a version of *Space Invaders* on their system disk which works very nicely with the PLAY command.

SAF does not currently offer anything approaching the utility of FHL's DBASIC or even Data-Comp's CCBASIC. They do, however, offer PBASIC which will copy Color and Extended BASIC into RAM. No disk functions have been implemented with PBASIC. Once in PBASIC, you may return to Flex by typing EXEC &HCD00. The folks at Spectral Associates are reportedly working on a program like FHL's DBASIC. I'm sure they will keep you posted.

Spectral Associates' NEWDISK command has a unique feature. Whenever you format a disk, NEWDISK automatically puts a bootstrap loader onto a few sectors. (FHL and Data-Comp think this is a waste of space. I think the convenience outweighs the loss of a few sectors.) A bootstrap loader is the program that gets you from Radio Shack Disk BASIC into Flex. Both FHL and Data-Comp require you to use a special procedure to place a bootstrap loader onto a disk.

One fault I find in SAF is the way disk seek rates are adjusted. In both FHL and Data-Comp Flex it is possible to permanently set the disk drive seek rates. SAF, however, tries to operate your drives at the fastest rate possible. If a read error occurs, the next fastest seek rate is used and so on until a solid read occurs. At first glance, this may seem like a good idea. After all, this is one way of automatically determining the capability of your drives. The trouble is that if *any* type of read error is ever encountered the seek rates go down and *stay* down. This is true even if you have the fastest drives possible. This does not hurt anything, only an inconvenience. Of course, if you have standard drives or if your fast drives never make a mistake, then this is no problem. I understand that Spectral Associates is planning to go to a manually adjustable seek rate in their next release of Flex+.

A representative at Spectral Associates has informed me that an expanded set of utilities will be available for purchase with Flex in the next few weeks; unfortunately, their package did not arrive in time to be included in this review. Spectral Associates has done a remarkable job so far, especially when you consider the newness of their Flex product.

Summation

All three companies were very helpful in explaining products over the phone—even before I identified myself as a reviewer for *the Rainbow* magazine.

Remember, all versions of Flex require 64K in your Color Computer. If your CoCo has less than 64K, upgrading can be accomplished with relatively little expense. All three companies provide instructions for the installation of 64K chips. Some CoCos and TDP 100s may need no upgrade at all. The new machines which came with 32K of RAM may actually have 64K available. Again, check with one of the Flex distributors.

I have found all three versions of Flex to work as advertised. There are considerable differences in the "extras" offered, however. Bear in mind that many of the extra or

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unique utilities from one company's Flex will work just fine on another version of Flex. Exceptions to this rule are the utilities which access undocumented portions of Flex and its disk drivers. An example of this is Frank Hogg's DBASIC which will only work with Frank Hogg's Flex. This is not intentional but simply due to the nature of the modifications to Flex.

Another point to consider is the compatibility of disk formats. All three Flex implementations are compatible for exchange of software on single sided disks. Only Frank Hogg Labs and Spectral Associates have made their Flex compatible for exchange on double sided disks. This is not a problem, really, since nearly all software sold for use with any version of Flex is written on single sided media.

Pricing deserves some consideration. Spectral Associates offers non-supercharger Flex at $69.95. The *Supercharger* version sells for $89.95. However, an Editor and Assembler will cost you an extra $25 apiece. FHL's Flex costs $69.95 and includes a Tiny Editor (TED) and a small Interactive Assembler. Full Feature Editors and Assemblers are available for an extra $69.95 as a package. I should point out that FHL's Editor and Assembler do offer a few more features than the TSC Editor and TSC Assembler sold by both Spectral Associates and Data-Comp. Data-Comp's Flex costs $199 but includes a full feature TSC Editor and TSC Assembler.

Spectral Associates, however, offers a similar package deal for the lowest price of $119.95. These are current April prices. I suspect that all three companies will strive to be competitive; so check *the Rainbow's* advertising sections before you decide.

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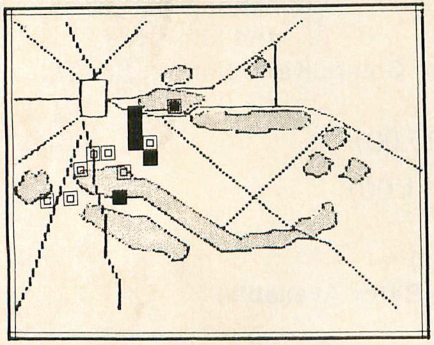

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Author's Post Script 5/11/83

This review, written in April, was submitted for comment to the three Flex distributors. Some of their reactions and comments were interesting.

There were a couple of factual errors which were corrected in the body of this text. The reactions also indicated a highly competitive spirit—some were even amusing, like who should be listed first. Allow me to set aside any fears of prejudicial treatment; the three companies are listed alphabetically.

Here is another point of clarification. I feel that Data Comp's "unusual printer driver" is a *good* idea. I like the way it provides an option to get my printer on line if it is not already on line.

Another comment by Data-Comp suggested their version of Flex was somehow more "standard." I would like to point out that all three companies use the "standard" TSC Flex as a basis for their products. "Standard" Flex, however, will not run on a CoCo without the necessary modifications. Documented Flex entry points are not changed in any of the three companies' Flex releases. All companies provide the Flex advanced programmers manual. All companies will sell you "standard" TSC Editors, Assemblers and BASIC. Some companies, however, offer you alternative choices in Editors, Assemblers and BASIC. Data Comp, Frank Hogg Labs and Spectral Associates have done a fine job in keeping Flex as standard as possible.

All three distributors indicated that they were basically satisfied with the review. Of the three, Spectral Associates had the fewest bones to pick—only a pricing correction. Frank Hogg Labs sent us a four page single spaced letter which rivaled the amount of space received in the review! Obviously, I cannot print all of their comments; however, my overall impression from their comments is that all three companies will do whatever is necessary to remain competitive.

For example, Data-Comp has included even more utilities with their package. Their external terminal program is now included free of charge. A multiple column catalogue command is provided. A file search command is provided. Grand total of "free" utilities is now 24, 12 of which include Source Code.

Frank Hogg Labs has come out with Version 5.0:4 with some fine additional features, including "Smooth Scrolling," a speedup of the normal scrolling; an improvement in their external terminal package; and green display screen option. FHL has also lowered the base price to $139.95.

Spectral Associates has also made improvements in their offering. A nice utility package is available which includes functions that allow you to modify individual disk sectors and alphabetize the directory. Another utility allows you to produce a "map" of the sectors occupied by any of the files on a disk. Spectral Associates still has the lowest price of $119.95 for non-supercharger Flex.

Gentlemen, I like your competitive spirit. I use all three of your Flex packages with satisfaction. My choice of package generally depends on the particular utility or unique function desired. Gentle readers, it is now up to you.

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Expanding Your Character File Programs

By Bob Albrecht and George Firedrake
Rainbow Contributing Editors

Millions of young people, and many not so young, are playing fantasy role playing games. A role playing game is a game in which one or more players create and control characters (adventurers) who live their imaginary lives in a specially made game world. The game world is created, managed, and operated by a GameMaster (GM), also called a referee, adventure master, or dungeon master (DM).

Most people who play role playing games use a formal rule system. Some of the best known are shown below.

Dungeons & Dragons (D&D). From TSR Hobbies, P.O. Box 756, Lake Geneva, WI 53147.

RuneQuest (RQ). From Chaosium, P.O. Box 6302, Albany, CA 94706.

Tunnels & Trolls (T&T). From Blade, Box 1467, Scottsdale, AZ 85252.

Worlds of Wonder (WOW). From Chaosium, P. O. Box 6302, Albany, CA 94706.

BEGINNERS BEWARE! The rule books are very difficult to understand. If you are a beginner, first try *Worlds of Wonder* or *Tunnels & Trolls*. Programs in "GameMaster's Apprentice" are based on the game system used in *Worlds of Wonder* and *RuneQuest*. For general information about fantasy role playing games, try the following book; it's excellent for beginners.

Through Dungeons Deep by Robert Plamondon. From Reston Publishing Company, 11400 Sunset Hills Road, Reston, VA 22090.
This book has good information related to **Dungeons & Dragons**

The Character File

Yup, here is yet another character file program. It stores the names and seven basic characteristics for a fantasy role playing game character. The program is structured like this:

When you first run the program, it begins with the menu in lines 200 through 450. The menu lets you select one of the three options in the program. You may look up a record by name of character, scan the entire file, or return to the menu.

The CHARACTER FINDER module is in lines 1000-1630. Use it to look up a character, using the name of the character as the search key. You can stay within this module or return to the menu.

The SCAN CHARACTER FILE module is in lines 2000-2430. Use it to scan the entire file, beginning with the first record. You can stay within this module or return to the menu.

Both modules use three subroutines, beginning at lines 10000, 11000, and 12000 respectively.

Both modules use a common *data base*, which begins at line 30000.

Let's look at the program a piece at a time. First the menu.

```
100 REM**CHARACTER FILE PROGRAM

200 REM**TELL HOW TO USE
210 CLS
220 PRINT "YOU CAN FIND A CHARAC
TER RECORD"
230 PRINT "BY NAME OF CHARACTER
OR YOU CAN"
240 PRINT "SCAN THE ENTIRE CHARA
CTER FILE."
250 PRINT @128, "MENU:"
260 PRINT @194, "TO FIND A RECOR
D,    PRESS '1'"
270 PRINT @226, "TO SCAN ENTIRE
FILE, PRESS '2'"
280 PRINT @258, "TO RETURN TO ME
NU,   PRESS '0'"

400 REM**WAIT FOR KEY
410 KEY$ = INKEY$
420 IF KEY$="" THEN 410
430 IF KEY$="1" THEN 1010
440 IF KEY$="2" THEN 2010
450 IF KEY$="0" THEN 210 ELSE 41
```

The menu accepts only the keys 1, 2, or 0. It will wait all day while you press other keys (except BREAK, of course). Do you see how another option, or several more, can be added to the menu? How would you change the menu program to use "F" to find a record, "S" to scan the entire file, and "M" to return to the menu?

(Bob Albrecht and George Firedrake are two of the most prolific authors in the microcomputer world today. Specialists in writing for beginners, they are authors of numerous books, including TRS-80 Color Basic.)

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If you press "1," you go to the CHARACTER FINDER module.

```
1000 REM**CHARACTER FINDER
1010 CLS
1020 INPUT "NAME OF CHARACTER";
WHO$
1030 RESTORE 'BEGINNING OF FILE

1200 REM**LOOK FOR WHO$
1210 GOSUB 11010 'GET A RECORD
1220 IF NAYM$=WHO$ THEN 1230 ELS
E 1410
1230 GOSUB 12010 'DISPLAY RECORD
1240 GOTO 1610

1400 REM**CHECK FOR EOF
1410 IF NAYM$="ENDFILE" THEN 142
0 ELSE 1210
1420 PRINT "I DON'T KNOW " WHO$

1600 REM**TELL HOW TO DO AGAIN
1610 GOSUB 10010 'GET REQUEST
1620 IF KEY$="0" THEN 210 'MENU
1630 GOTO 1010
```

In lines 1030, 1210, 1230, 1610, and 1620 we include remarks following the apostrophe (') to help you understand what is happening. You don't have to enter this part of the line—explanatory comments are for people.

Lines 1210, 1230, and 1610 call on subroutines. These subroutines are also used by the SCAN CHARACTER FILE module. Using subroutines this way gives us lots of flexibility. For example, we can change the structure of the file without having to rewrite the modules!

To get back to the menu, press the "0" key. This is handled in line 1620.

Suppose the menu is on screen and you press the "2" key. Presto, you arrive at the SCAN CHARACTER module.

```
2000 REM**SCAN CHARACTER FILE
2010 CLS
2020 RESTORE 'BEGINNING OF FILE

2200 REM**READ & DISPLAY RECORD
2210 GOSUB 11010 'READ A RECORD
2220 GOSUB 12010 'DISPLAY RECORD

2400 REM**TELL HOW TO DO AGAIN
2410 GOSUB 10010 'GET REQUEST
2420 IF KEY$="0" THEN 210 'MENU
2430 IF NAYM$="ENDFILE" THEN 202
```

This module is short because most of the work is done by the subroutines beginning at lines 10000, 11000, and 12000. Line 2420 gets you back to the menu, if you should press the "0" key at the appropriate time.

The DO AGAIN SUBROUTINE provides some information, then waits for you to press either the space bar or the "0" key.

```
10000 REM**DO AGAIN SUBROUTINE
10010 PRINT
10020 PRINT "TO DO AGAIN, PRESS
SPACE"
```

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```
10030 PRINT "TO RETURN TO MENU,
PRESS '0'";
10040 KEY$ = INKEY$
10050 IF KEY$="" THEN 10040
10060 IF KEY$=" " THEN RETURN
10070 IF KEY$="0" THEN RETURN
```

This subroutine is called by both modules. See lines 1610 and 2410.

The READ RECORD SUBROUTINE is called by both modules. See lines 1210 and 2210.

```
ELSE 10040
10099 :
11000 REM**READ RECORD SUBR.
11010 READ NAYM$
11020 READ STR, CON, SIZ, INQ, P
OW, DEX, CHA
11030 RETURN
```

The PRINT RECORD SUBROUTINE is called by both modules. See lines 1230 and 2220.

```
12000 REM**PRINT RECORD SUBR.
12010 CLS
12020 PRINT NAYM$: PRINT
12030 PRINT "STR", STR
12040 PRINT "CON", CON
12050 PRINT "SIZ", SIZ
12060 PRINT "INT", INQ
12070 PRINT "POW", POW
12080 PRINT "DEX", DEX
12090 PRINT "CHA", CHA: RETURN
12099 :
```

Here is the **data base**, the **file** of **records** about characters.

```
30000 REM**CHARACTER RECORDS
30010 DATA ALOYSIOUS, 10, 11, 10
, 12, 10, 12, 9
30020 DATA BAROSTAN, 17, 17, 13,
 8, 7, 15, 6
30030 DATA BRIDLA, 11, 12, 10, 1
5, 6, ii, i6
30040 DATA DERNFARA, 13, 13, 8,
13, 4, 17, 6
30050 DATA JOLEEN, 13, 11, 7, 13
, 8, 17, 13
30060 DATA ROKANA, 9, 9, 9, 17,
18, 9, 10
30070 DATA ENDFILE, 0, 0, 0, 0,
0, 0, 0
```

Each record consists of a name followed by seven numbers. The last record (ENDFILE) is not an actual character record. It simply marks the end of the file. Add as many records as you want, beginning at line 30070, then put ENDFILE as the last record in *your* file.

YOUR TURN. Modify the program in any of the following ways.

1. Change the CHARACTER FINDER module so you look up a character without spelling the full name. For example, type only "A" to find ALOYSIOUS. This works since this is the only record beginning with A. To find BRIDLA, type "BR" and to find BAROSTAN, type "BA." If you type just "B," you will find BAROSTAN since his record occurs before BRIDLA's record.

2. Modify the program to store the name and the *six* basic characteristics for a *Dungeons & Dragons* Character.

CHARACTERISTIC	ABBREVIATION
Strength	STR
Constitution	CON
Intelligence	INT
Wisdom	WIS
Dexterity	DEX
Charisma	CHA

3. Expand the amount of information stored for each character or change the type of information completely—how about a name, address, and telephone number file? Look up information by name (or partial name) or by telephone number.

4. Rewrite the program so the records are first read into *arrays* or *subscripted variables*. For example, the information for Aloysious is read into NAYM$(1), STR(1), CON(1), SIZ(1), INT(1), POW(1), DEX(1), and CHA(1). The information for Barostan is read into NAYM$(2), STR(2), CON(2), SIZ(2), INT(2), POW(2), DEX(2), and CHA(2). And so on—where will you put the ENDFILE information?
How do you get the information into the arrays? Here are three possibilities:
   Read the information from *DATA* statements.
   Load the information from a *cassette file*.
   Load the information from a *disk file*.

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Surely, but slowly, we will explore most of the above.

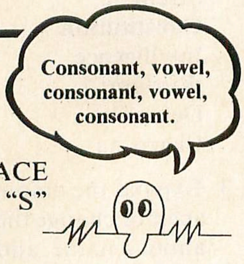
The Name Machine

The sound of a name is determined by its consonant—vowel structure. Here is a program that lets the user specify the sequence of consonants and vowels for random names. For example, a *RUN* might go like this:

```
NAME STRUCTURE? CVCVC

     20 names

FOR MORE NAMES, PRESS SPACE
FOR NEW STRUCTURE, PRESS "S"
```


Consonant, vowel, consonant, vowel, consonant.

If you press the space bar, you get 20 more names of the form CVCVC. But if you press the "S" key, you can enter a new structure.

When the CoCo asks NAME STRUCTURE? enter a string of Cs and Vs, C for consonant, V for vowel. Here are some examples.

NAME STRUCTURE	POSSIBLE NAMES
CVC	TOM, ZAP, GUZ, JYM
VCVC	ZMOS, ENAP, ITOK
CVCVC	ROKAN, TOMAR, ZULAK

You can sometimes convert a masculine sounding name to a feminine sounding name by adding a vowel. For example, ROKAN and ROKANA.

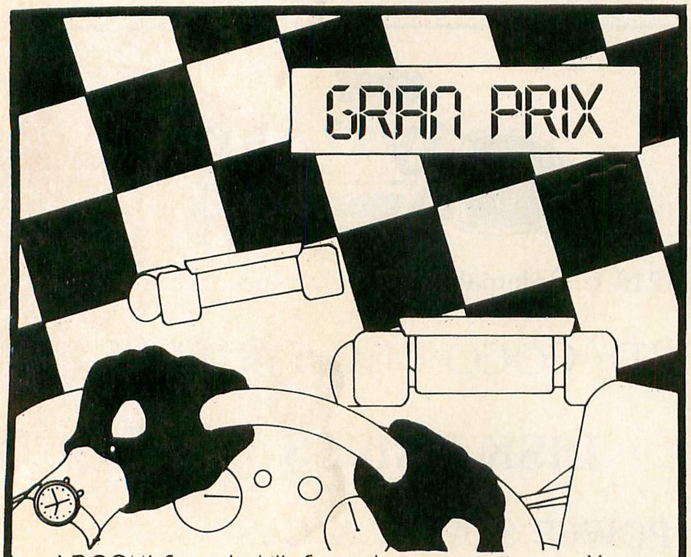
```
100 REM**RANDOM NAMES

200 REM**GET NAME STRUCTURE NS$
210 CLS
220 INPUT "NAME STRUCTURE"; NS$

300 REM**MAKE & PRINT NAMES
310 CLS
320 PRINT "NAME STRUCTURE: " NS$
330 PRINT
340 FOR K=1 TO 20
350 : GOSUB 610
360 : PRINT NAME$,
370 NEXT K

500 REM**TELL HOW TO DO AGAIN
510 PRINT
520 PRINT "FOR MORE NAMES, PRESS
 SPACE"
530 PRINT "FOR NEW STRUCTURE, PR
ESS 'S'";
540 K$=INKEY$: IF K$="" THEN 540
550 IF K$=" " THEN 310
560 IF K$="S" THEN 210 ELSE 540

600 REM**MAKE A NAME SUBR.
610 NAME$ = ""
620 FOR KK=1 TO LEN(NS$)
630 : CV$ = MID$(NS$, KK, 1)
```



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```
640 : IF CV$="C" THEN GOSUB 810
650 : IF CV$="V" THEN GOSUB 910
660 NEXT KK
670 RETURN

800 REM**ADD A CONSONANT SUBR.
810 C$="BCDFGHJKLMNPQRSTVWXYZ"
820 RC = RND(21)
830 RC$ = MID$(C$, RC, 1)
840 NAME$ = NAME$ + RC$
850 RETURN

900 REM**ADD A VOWEL SUBR.
910 V$="AEIOUY"
920 RV = RND(6)
930 RV$ = MID$(V$, RV, 1)
940 NAME$ = NAME$ + RV$
950 RETURN
999 END
```

In Pursuit Of Non-Violence

We have been challenged by Dick Ricketts, editor of *The Computing Teacher*, to replace the violent phrase "To kill two birds with one stone" with something less violent. Several of us are working on this problem. From time to time, we will send Dick a shoebox full of replacement phrases written on bar napkins, backs of envelopes, cash register receipts, and other exotic media. Here are a few samples.

To get two hugs with one smile
To get two smiles with one hug
To feed two birds with one worm
To embarrass two politicians with one truth

Please help inundate Dick with good slogans. Send them to Dick Rickets, *The Computing Teacher*, University of Oregon, Eugene, OR 97403.

Coming Attractions

Surely, but slowly, we will explore the following things:

- The elusive *RND*
- GameMaster's Dice
- Looking up stuff in files. First, files of information in *DATA* statements and arrays. Next, cassette files. Eventually, disk files.
- Whatever else comes to mind or is suggested by you.

What do *you* want? If it fits into the general idea of "GameMaster's Apprentice," we might do it. Send your suggestions, complaints, kudos, requests, whatever. . . to George & Bob, P.O. Box 310, Menlo Park, CA 94025.

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SPECIAL

COLOR COMPUTER MEMORY MAP

By BOB RUSSELL

This is the first installment in a comprehensive series of references on the Color Computer memory, and covers Random Access Memory (RAM).

This memory map has been created after many hours of research, investigation and experimentation. I probably have over 650 hours already invested in this project and I know I am not finished. I fully intend to offer periodic updates to this document. My wish is that this will become a living, growing document that you will also contribute to. I hope you will bring any errors to my attention and also share any unmapped discoveries you may have made.

Among those publications offering the most accurate and reliable memory information are Radio Shack's Service Manual, *Color Computer News* and *the Rainbow*. If you refer to these resources you will often find detailed information (sometimes even a commented listing that can be matched to a disassembled listing to really describe what is going on!). Throughout the Map, I will refer to some of these resources.

An *S* indicates a ROM or RAM based routine that you could potentially call from your own assembly language program. $nnn is a notation for hexadecimal values.

Sources referred to in this map:

1) *Getting Started With Color* BASIC
Copyright 1981 Tandy Corp.
Fort Worth, TX 76102
2) *Going Ahead With Extended* BASIC
Copyright 1981 Tandy Corp.
Forth Worth, TX 76102
3) *Service Manual, TRS-80 Color Computer*
Catalog Number 26-3001/3002
4) *TRS-80 Microcomputer News*
(for TRS-80 users)
P.O. Box 2910
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5) *Color Computer News*
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For making inquiries or placing orders, write: Bob Russell, N5474 Stillwater Court, Fredonia, WI 53021.

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```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                        Description
----- ---- ----- ----    ----------------------------------------------
00000 0000 32767 7FFF    RAM

 00000 0000 01023 03FF    System Use

  00003 0003               General Counter

  00006 0006               String flag

  00007 0007               Garbage Collection Flag

  00025 0019 00026 001A    Address of start of BASIC program

  00027 001B 00028 001C    Address of start of variable storage also
                           address-1 is end of BASIC program

  00029 001D 00030 001E    Address of start of arrays (subscripted
                           variable storage

  00031 001F 00032 0020    Address of beginning of free memory used in
                           NEW command.

  00033 0021 00034 0022    Address of start of string pool (string stack)

  00035 0023 00036 0024    Address of Basic limit

  00037 0025               Pointer to string in string pool

  00039 0027 00040 0028    Highest available ram address (end of string
                           pool)

  00051 0033 00052 0034    Pointer  to values in data statements

  00065 0041 00072 0048    Scratch area used by Tokenizing routine, garbag
                           collection routine, move memory block routine

   00065 0041 00072 0048    Data for Block Move

    00065 0041 00066 0042    High end destination address

    00067 0043 00068 0044    High end origin address

    00069 0045 00070 0046    Low end destination address

    00071 0047 00072 0048    Low end origin address

  00079 004F 00084 0054    Floating point accumulator 1 (FPAC1)

   00079 004F               Exponent

   00080 0050 00083 0053    Mantissa

   00084 0054               Sign
```

```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                        Description
----- ---- ----- ----    ----------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

 00000 0000 01023 03FF    System Use Cont.

  00086 0056               String variable length

  00092 005C 00097 0061    Floating point accumulator 2 (FPAC2)

   00092 005C               Exponent

   00093 005D 00096 0060    Mantissa

   00097 0061               Sign

  00098 0062               Sign comparison

  00099 0063               Extended precision byte

  00108 006C               Current column position (value of pos)

  00111 006F               Device DEVNUM[2]
                              -2=Printer
                              -1=Cassette
                              0=Screen
                              1-15 File for Disk BASIC

  00113 0071               Warm start flag (RSTFLAG[2])
                              $12= Do warm start
                              $0 = Condition before cartridge prog.
                                   starts created by BASIC

                              $55= IF RSTVEC[2] pointS to a NOP $12 then
                                   control is transfered to address RSTVEC
                                   else BASIC starts up

  00114 0072 00115 0073    Warm start vector address (RSTVEC[2]). At power
                           up this contains $80C0

  00116 0074 00117 0075    Highest physical memory address

  00124 007C               Block type BLKTYP[2]
                              0=file header
                              1=data
                              FF=end of file

  00125 007D               Bytes in block 0-255 BLKLEN[2]
                              Z=1,A=CSRERR=0 for no errors
                              Z=0,A=CSRERR=1 for checksum error
                              Z=0,A=CSRERR=2 for memory error
```

```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                        Description
----- ---- ----- ----    ---------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

  00000 0000 01023 03FF    System Use Cont.

    00126 007E                 Buffer address CBUFAD[2]. Also program end
                               address + 1 after CLOADM.

    00128 0080                 Checksum

    00129 0081                 CSRERR[2]

    00130 0082                 General counter

    00131 0083                 Pulse width count

    00132 0084                 Rise/fall flag (0=rise)

    00133 0085                 Last sine value

    00136 0088  00137 0089     Address of current cursor location

    00138 008A  00139 008B     2 bytes always containing zeros

    00140 008C                 Pitch of sound (frequency)

    00141 008D  00142 008E     Duration of sound

    00143 008F                 Full wave threshold $12

    00144 0090                 Noise rejection $18

    00145 0091                 Half wave threshold $0A

    00146 0092                 Gap length $80. Controls length of unmodulated
                               carrier preceding I/O Ref. [6]Vol II No. 2

    00148 0094                 Cursor color (poke 0 to make cusor disappear)

    00149 0095  00156 009C     Printer variables

      00149 0095 00150 0096      RS-232 baud rate LPTBTD[2]

                                 HEX   MSB, LSB(Decimal)  Baud
                                       149  150
                                 $02EB  2 ,235              75
                                 $01CA  1 ,202             120
                                 $0173  1 ,115             150
                                 $00BE  0 ,180             300
                                 $0057  0 , 87             600 Default
                                 $0029  0 , 41            1200
                                 $0012  0 , 18            2400
                                 $0006  0 ,  6            4800
                                 $0001  0 ,  1            9600
```

```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                        Description
----- ---- ----- ----    ---------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

  00000 0000 01023 03FF    System Use Cont.

    00149 0095  00156 009C   Printer variables Cont.

      00151 0097 00152 0098    RS-232 line return delay LPTLND[2]

                               HEX    MSB, LSB(Decimal) Delay in sec.
                                      151  152
                               $0001    0,   1             0  Default
                               $4000   64,   0          .288
                               $8000  128,   0          .576
                               $FFFF  255, 255          1.15

      00153 0099               RS-232 comma field width $10 OR 16 DEFAULT

      00154 009A               RS-232 last comma field width $70 OR 112
                               default

      00155 009B               RS-232 line printer width

                               HEX  (Decimal)  char/line
                               $10    16         16
                               $20    32         32
                               $40    64         64
                               $84   132        132 Default
                               $FF   255        255

      00156 009C               Print head position LPTPOS[2]

    00157 009D 00158 009E    Transfer address after CLOADM. Ref. [6]Vol.
                             II No 2.

    00159 009F 00168 00A8    *S* Get next character routine. A JSR $009F will
                             get the next byte. JSR $00A5 will get the same
                             byte. Ref [5] #12

    00166 00A6 00167 00A7    Next character pointer

    00168 00A8 00170 00AA    Vector to 43376. Contains $7EAA1A (jump AA1A) to
                             print "OK"

    00171 00AB 00174 00AE    Extended product area 32 bits of a 64

    00181 00B5 00219 00DB    Graphics data/constants

      00181 00B5               Current color; if 4 color mode legal values
                               are $00,$55,$AA,$FF; if 2 color mode legal
                               values are $00 or $FF

      00182 00B6               Current Pmode
```

```
 Beginning  Ending
 DEC   HEX  DEC   HEX
 ADDR  ADDR ADDR  ADDR                   Description
 ----- ---- ----- ----   -------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

  00000 0000 01023 03FF    System Use Cont.

    00181 00B5 00219 00DB    Graphics data/constants cont.

      00185 00B9                 Number of bytes per line

      00186 00BA                 Address of top of graphics page

      00188 00BC                 Contains $0E if Disk system else $06

      00189 00BD                 X1

      00191 00BF                 Y1

      00195 00C3                 X2

      00197 00C5                 Y2

      00219 00DB                 Change flag

    00230 00E6               Baud rate constant

    00231 00E7               Input timeout constant

    00234 00EA 00239 00EF    Disk I/O variables [5] #9

      00234 00EA                 Disk operation code

      00235 00EB                 Drive number

      00236 00EC                 Track number

      00237 00ED                 Sector number

      00238 00EE 00239 00EF      Buffer address

    00240 00F0               Disk status returned

    00256 0100 00273 0111    Interrupt vectors

      00256 0100 00258 0102      SWI3 - Software Interrupt 3 called from $FFF2
                                 Execution of a SWI3 instruction ($113F) will
                                 stack registers and jump here.

      00259 0103 00261 0105      SWI2 - Software Interrupt 2 called from $FFF4
                                 Execution of a SWI2 instruction ($103F) will
                                 stack registers and jump here.

      00262 0106 00264 0108      SWI1 - Software Interrupt 1 called from $FFFA
                                 Execution of a SWI1 instruction ($3F) will
                                 stack registers and jump here.
```

```
 Beginning  Ending
 DEC   HEX  DEC   HEX
 ADDR  ADDR ADDR  ADDR                   Description
 ----- ---- ----- ----   -------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

  00000 0000 01023 03FF    System Use Cont.

    00256 0100 00273 0111    Interrupt vectors Cont.

      00265 0109 00267 010B      NMI - Non-Maskable Interrupt called from
                                 $FFFC Set to $7ED7AE (JMP $D7AE) by
                                 initialization of Disk Operating System.

      00268 010C 00270 010E      IRQ - Interrupt Request called from $FFF8
                                 Set to $7EA9B3 (JMP $A9B3) by initialization
                                 of Basic. Set to $7E894C (JMP $894C) by
                                 initialization of Extended Basic. Set to
                                 $7ED7BC (JMP $D7BC) by initialization of the
                                 Disk Operating System. This is primarily a
                                 timing interrupt and is used by SOUND & TIMER
                                 commands and to turn off Disk Motor when disk
                                 has not been accessed for several seconds.

      00271 010F 00273 0111      FIRQ - Fast Interrupt Request called from
                                 $FFF6. Set to $7EA0F6 (JMP $A0F6) by
                                 initialization of Basic. This causes a jump
                                 to the cartridge port in the expansion
                                 interface.

    00274 0112 00276 0114    *S* Execution of "USR" Basic function (Token
                               $FF83) USRJMP jump to basic's usr routine[1]
                                also 274-275 high and low order bytes of
                                TIMER Ref. [6] Vol II No 2

    00278 0116 00281 0119    Seed for RND function Ref. [6] Vol II No 2

    00282 011A               Keyboard alpha lock (upper or lower case
                             selection) [1]

                             0 = not locked (lower case)
                             1 = locked (upper case)

    00283 011B 00284 011C    Keyboard delay constant[1]

    00285 011D 00287 011F    Vector to 45509. Contains $7E8489
                             (JMP $8489)
```

```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                          Description
----- ---- ----- ----    --------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

 00000 0000 01023 03FF    System Use Cont.

  00288 0120 00316 013C    Token Table Directory Ref. [5] No.7 and Ref.
                           [7] December Anniversary Issue

    00288 0120 00292 0124    Basic Commands

      00288 0120               Number of BASIC command keywords in token
                               table located at $AA66-$AB19 ($35)

      00289 0121 00290 0122    Address of BASIC Command Keyword Table
                               ($AA66)

      00291 0123 00292 0124    Address of table of pointers to BASIC
                               Command subroutine entry addresses
                               ($AB67)

    00293 0125 00297 0129    Basic Functions

      00293 0125               Number of BASIC function keywords in token
                               table located at $AB1A-$AB66 ($14)

      00294 0126 00295 0127    Address of BASIC function Keyword table
                               ($AB1A)

      00296 0128 00297 0129    Address of table of pointers to BASIC
                               Function  subroutine entry addresses
                               ($AA29)

    00298 012A 00302 012E    Extended Basic Commands

      00298 012A               Number of Extended BASIC Command keywords
                               in token table located at $8183-$81EF ($19)

      00299 012B 00300 012C    Address of Extended Basic Command keyword
                               table ($8183)

      00301 012D 00302 012E    Address of a subroutine that determines
                               subroutine entry addresses for tokens
                               $B5 to $CB and $FF90to $FF9F. ($813C)
```

```
Beginning  Ending
DEC   HEX  DEC   HEX
ADDR  ADDR ADDR  ADDR                          Description
----- ---- ----- ----    --------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

 00000 0000 01023 03FF    System Use Cont.

  00288 0120 00316 013C    Token Table Directory Ref. [5] No.7 and Ref.
                           [7] December Anniversary Issue Cont.

    00303 012F 00307 0133    Extended Basic Functions

      00303 012F               Number of Extended BASIC Function keywords
                               in token table located at $821E-$8272 ($E)

      00304 0130 00305 0131    Address of Extended Basic Function keyword
                               table ($821E)

      00306 0132 00307 0133    Address of a subroutine that determines
                               subroutine entry addresses for tokens
                               $FF94 to $FF9F with the exception of $FF90
                               and $FF9F. ($8168)

    00308 0134 00312 0138    Disk Basic Command
      00308 0134               Number of tokens
      00309 0135 00310 0136    Address of Keyword Table
      00311 0137 00312 0138    Address of where to go to execute a token

    00313 0138 00317 013C    Disk Basic Function
      00313 0138               Number of tokens
      00314 0139 00315 013A    Address of Keyword Table
      00316 013B 00317 013C    Address of where to go to execute a token
  Beginning  Ending
  DEC   HEX  DEC   HEX
  ADDR  ADDR ADDR  ADDR                     Description
  ----- ---- ----- ----    ----------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

   00000 0000 01023 03FF    System Use Cont.

      00338 0152 00345 0159    Keyboard rollover table [4] Oct 1981

                                  Bit 7   6   5   4   3   2   1   0
         00338 0152                     ENTER 8   0   X   P   H   @
         00339 0153                     CLEAR 9   1   Y   Q   I   A
         00340 0154                           :   2   Z   R   J   B
         00341 0155                           ;   3   ~   S   K   C ~= UP ARROW
         00342 0156                           ,   4   ~   T   L   D ~= DN ARROW
         00343 0157                           -   5   ~   U   M   E ~= LT ARROW
         00344 0158                           .   6   ~   V   N   F ~= RT ARROW
         00345 0159                           /   7   ~   W   O   G ~= BLANK
                   Dec val of contents  191 223 239 247 251 253 254
                   of 338-345 if key in
                   col. is pressed

                                      1   1   1   1   1   1   1   1
                                      Is the binary value or $FF or 255
                                      when no key is pressed

                                      If right joystick fire button is pressed:
                                      1   1   1   1   1   1   1   0
                                      Is the binary value or $FE or 254 at all
                                      locations $152-$159 or 338-345

                                      If left joystick fire button is pressed:
                                      1   1   1   1   1   1   0   1
                                      is the binary value or $FD OR 253 at all
                                      locations $152-$159 or 338-345

                                      When a key or mutiple keys are
                                      simultaneously pressed the 1's toggle to
                                      zero bit at col positions corresponding
                                      to table above

                                      Example: 'A' key is pressed
                                      1   1   1   1   1   1   1   0
                                      is the binary val or $FE OR 254 at
                                      location $153 or 339

                                      Example: 'd' and '4' keys are pressed
                                      simultaneously
                                      1   1   1   0   1   1   1   0
                                      is the binary val or $EE OR 238 at
                                      location $156 OR 342
```

```
  Beginning  Ending
  DEC   HEX  DEC   HEX
  ADDR  ADDR ADDR  ADDR                      Description
  ----- ---- ----- ----    ---------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

   00000 0000 01023 03FF    System Use Cont.

      00346 015A 00349 015D    Joystick pot values[1]

         00346 015A                Joystick 0 x position left

         00347 015B                Joystick 0 y position left

         00348 015C                Joystick 1 x position right

         00349 015D                Joystick 1 y position right

      00350 015E 00423 01A8    Hooks to Ram area from Roms. Unless otherwise
                               defined assume Basic initializes hooks with
                               $39 (RTS) Ref. [5] #11

         00350 015E                Hook to allow device numbers 1-16 to be
                                   opened to disk files. Called from $A5F7. Set
                                   to $7EC426 (JMP $C426) by initialization of
                                   Disk Operating System.

         00353 0161 00255 0163     Hook to allow device numbers greater than 0
                                   for disk. Called from $A5B9. Set to $7EC838
                                   (JMP $C838) by intitialization of Disk
                                   Operating System.

         00356 0164 00358 0166     Hook to return device parameters for disk
                                   files such as current position in record,
                                   tab length, etc. Called from A35F. Set to
                                   $7EC843 (JMP $C843 by initialization of Disk
                                   Operating System.

         00359 0167 00361 0169     Hook to allow user interface of other types
                                   of terminals or printers with different
                                   protocols. This location is referenced during
                                   each print. Extended Basic changes graphic
                                   screen back to text and ignores output to
                                   device #3 used in DLOAD. Disk operating
                                   system enables output to disk files. Set to
                                   $39 (RTS) by initialization of Basic. Set to
                                   $7E8273 (JMP $8273) by initialization of
                                   Extended Basic. Set to $7ECB4A (JMP $7ECB4A)
                                   by Disk Operating System. User may poke or
                                   load a JMP to user defined modified RS232
                                   driver then exiting driver and executing the
                                   proper JMP depending on system being run.
                                   Ref. [5] #6 & #11
```

```
Beginning  Ending
DEC   HEX  DEC    HEX
ADDR  ADDR ADDR   ADDR                 Description
----- ---- -----  ----   ---------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

 00000 0000 01023 03FF    System Use Cont.

   00350 015E 00423 01A8    Hooks to Ram area from Roms. Unless otherwise
                            defined assume Basic initializes hooks with
                            $39 (RTS) Ref. [5] #11 Cont.

      00365 016D 00367 016F    Hook to make sure that a device number is
                               open for input. Called from $A3ED. Set to
                               $7EC818 (JMP $C818 ) by initialization of
                               Disk Operating System.

      00371 0173 00373 0175    Hook to allow closing of all open files.
                               Called from $A426. Set to $7ECA3B (JMP $CA3B)
                               by initialization of Disk Operating System.

      00374 0176 00376 0178    Hook to allow closing of the file opened to a
                               specified device number. Called from $A42D.
                               Set to $7ECA4B (JMP $CA4B) by initialization
                               of Disk Operating System. Set to $7E8286 by
                               initialization of Extended Basic.

      00377 0179 00379 017B    Hook to enable PRINTUSING  statement. Called
                               from $B918. Set to $7E8E90 (JMP $8E90) by
                               initialization of Extended Basic.

      00380 017C 00382 017E    Hook to enable INPUT statements from disk.
                               Called from $B051. Set to $7ECC5B (JMP $CC5B)
                               by initialization of Disk Operating System.

      00383 017F 00385 0181    Hook to enable/disable BREAK key. BREAK key
                               is disabled during disk ouput. Called from
                               $A549. Set to $7EC859 (JMP $C859) by
                               initialization of Disk Operating System.

      00386 0182 00388 0184    Hook to enable line input. Called from $A390.
                               Set to $39 (RTS) by initialization of Disk
                               Operating System.

      00389 0185 00391 0187    Hook to enable cleanup after loading an ASCII
                               file. Called from $A4BF. Set to $7ECA36
                               (JMP $CA36) by initialization of Disk
                               Operating System.

      00392 0188 00394 018A    Hook to enable check for end of disk file.
                               Called from $A5CE. Set to $7EC860 (JMP $C860)
                               by initialization of Disk Operating System.

      00395 018B 00397 018D    Hook to evaluate Extended Basic Operands and
                               Functions. Called from $B223. Set to $7E8846
                               (JMP $8846) by initialization of Extended
                               Basic. Set to $7ECDF6 (JMP $CDF6) by
                               initialization of Disk Operating System.
```

```
Beginning  Ending
DEC   HEX  DEC    HEX
ADDR  ADDR ADDR   ADDR                 Description
----- ---- -----  ----   ---------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

 00000 0000 01023 03FF    System Use Cont.

   00350 015E 00423 01A8    Hooks to Ram area from Roms. Unless otherwise
                            defined assume Basic initializes hooks with
                            $39 (RTS) Ref. [5] #11 Cont.

      00398 018E 00400 0190    Hook to allow a user program to trap errors.
                               Called from $AC46. Set to $39 (RTS) by
                               initialization of Disk Operating System. Set
                               to $7EC70D by initialization of Extended
                               Basic.

      00401 0191 00403 0193    Hook to print Extended and Disk Basic Error
                               messages. Also closes files upon errors.
                               Called from $AC49. Set to $7E88F0 (JMP $88F0)
                               by initialization of Extended Basic. Set to
                               $7EC24D (JMP $C24D) by initialization of
                               Disk Operating System.

      00404 0194 00406 0196    Hook to set up Graphics parameters for
                               Extended Basic. Also enables RUN "filename"
                               for Disk Basic. Called from $AE75. Set to
                               $7E829C (JMP $829C) by initialization of
                               Extended Basic. Set to $7EC990 (JMP $C990)
                               by initialization of Disk Operating System.

      00407 0197 00409 0199    Hook to enable Hex (&H) and Octal (&O)
                               conversions. Called from $AD9E. Set to
                               $7E87E5 (JMP $87E5) by initialization of
                               Extended Basic.

      00410 019A 00412 019C    Hook to allow user control of extended Basic
                               interpreter. Called from $AD9E after
                               interpreting each Basic statement. Set to
                               $7E82B9 (JMP $82B9) by initialization of
                               Extended Basic. Purpose of Hook to Extended
                               Basic is to enable TRACE function. It can be
                               used to disable the BREAK key or SHIFT @ key.
                               This speeds up Basic. Ref. [5] #6

      00413 019D 00415 019F    Hook for Graphics. Called from $A8C4.

      00416 01A0 00417 01A2    Hook to allow Get and Put routines to access
                               disk records. Called from $8162,$8AFA,$975C,
                               $A910, and $C29A. Set to $7EC29A (JMP $C29A).

      00418 01A3 00420 01A5    Hook for Extended Basic interpreter
                               tokenization Called from $B821. Set to
                               $7E8304 (JMP $8304) by initialization of
                               Extended Basic.

      00421 01A6 00423 01A8    Hook for Extended Basic interpreter
                               untokenize. Called from $B7C2.
 Beginning  Ending
 DEC   HEX  DEC   HEX
 ADDR  ADDR ADDR  ADDR                    Description
 ----- ---- ----- ----    ----------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

  00000 0000 01023 03FF    System Use Cont.

     00465 01D1              Length of file

     00466 01D2 00473 01D9   Cassette filename 8 bytes

     00474 01DA 00731 02D8   Cassette buffer 255 bytes

     00485 01E5 00486 01E6   Transfer address used in CSAVEM command

     00733 02DD 00988 03DC   Keyboard buffer 255 bytes (input terminated
                             by 0). When data is tokenized it is stored
                             starting at 00732 ($02DC)

     00737 02E1 00827 033B   Screen Buffer (90 bytes)

  01024 0400 01535 05FF    Text screen memory (normal video display)[1]

  01536 0600 13823 35FF    GRAPHICS PAGE AREA[2]

     01536 0600 03071 0BFF   Page 1

     03072 0C00 04607 11FF   Page 2

     04608 1200 06143 17FF   Page 3

     06144 1800 07679 1DFF   Page 4

     07680 1E00 09215 23FF   Page 5

     09216 2400 10751 29FF   Page 6

     10752 2A00 12287 2FFF   Page 7

     12288 3000 13823 35FF   Page 8

  01536 0600 02438 0986    Disk buffers,variable storage, and DOS variable
                           storage (NOTE CONFLICT WITH GRAPHICS PAGE 1!!!!)
                           Ref. [5] #9.

     01536 0600 01791 06FF   Disk buffer for Disk I/O - 1 sector long - 256
                             bytes

     01792 0700 02047 07FF   Disk buffer for Disk I/O - 1 sector long - 256
                             byte

     02048 0800 02343 0927   Disk drive table - 74 bytes data per drive

     02344 0928              Start of DOS variables
```

```
 Beginning  Ending
 DEC   HEX  DEC   HEX
 ADDR  ADDR ADDR  ADDR                    Description
 ----- ---- ----- ----    ----------------------------------------------
00000 0000 32767 7FFF    RAM Cont.

  01536 0600 02438 0986    Disk buffers,variable storage, and DOS variable
                           storage (NOTE CONFLICT WITH GRAPHICS PAGE 1!!!!)
                           Ref. [5] #9. Cont.

     02430 097E 02438 0986   Disk variable storage

        02430 097E              Start of table of current tracks

        02434 0982              NMI in use flag

        02435 0983              Address of return after NMI interrupt

        02437 0985              Motor shutoff counter

        02438 0986              Current Latch data - status of 1793 register
                                in RAM

  13824 3600 32767 7FFF    Program and variable storage (program and
                           variable storage could actually begin anywhere
                           from 03072 to 13824 (allowing for Disk Operating
                           System operation) depending on graphics page
                           area required)[1]
```

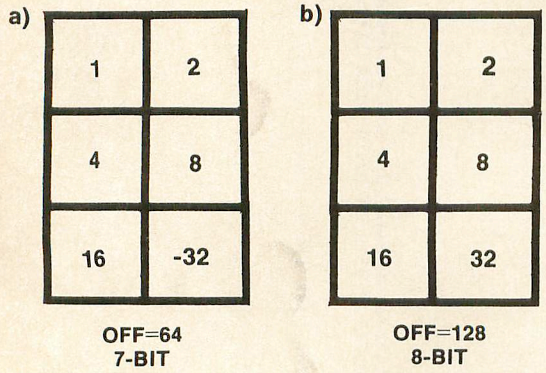
PRINTOUT AT *PMODE 4*

By Joseph Kohn

Most of the graphics screen print routines available support the dot addressable capabilities of the TRS line printers. This has left those of us with Microline printers, and perhaps Epson, out in the cold. This machine language routine allows any PMODE4 screen to be dumped to a Microline printer.

By using eight lines per inch, compressed printing, and six-block graphics characters, the Microlines can fill a large portion of an 8½ x 11 page with the full high-resolution screen. The main body of the program is concerned with translating the graphics pixels into six-block printer graphics characters.

The six-block characters can be treated as six pixels, two across by three down. With compressed printing, 132 characters can be printed on a line. This gives a resolution of 264 pixels, which is convenient, as the PMODE4 screen has 256 pixels across. Therefore, the full screen width can be printed with a string of 128 graphics characters. Going further, this string can print three rows of hi-res pixels. This means that 64 strings are needed to print the full screen height, 192 pixels.



Print Code=OFF +Pixel Value

Figure 1. Six-Block Pixel Value

Now that the screen and printer pixel relationships are established, the next problem is finding the screen pixels. In PMODE4, the computer stores eight pixels in each graphics page byte. Therefore, each row of pixels is stored in 32 bytes. To compile the printing string, 96 bytes must be examined, 32 for each row of the six-block characters.

Lastly, the six-block print code must be formed. The code is the same as the value you would use with the BASIC CHR$ function. The value of each six-block pixel is shown in Figure 1 for both the 7-bit and 8-bit printer modes. Remember that the CoCo BASIC 1.0 ROM uses 7-bits for the printer whereas the BASIC 1.1 ROM can use either 7 or 8 bits. The internal printer DIP switch must be set to the appropriate mode.

Now that the mechanics are defined, on with the program. As presented here, the program supports the 7-bit mode. The changes for

8-bit are given at the end. The code is position independent and can be located anywhere it will not interfere with the graphics pages to be printed. The source code listing starts at $4000 (ORG $4000) which is convenient for a 32K machine, ORG $3000 would be appropriate for a 16K.

Once assembled, the program is loaded using *CLOADM* followed by an *EXEC* command. The program is self-prompting. Since the program ends with and RTS instruction, it can be used as a subroutine for either a BASIC or machine language program. Calling from BASIC requires the *DEFUSR* and *USR* commands.

The following description is by lines. The program was assembled using the TRS EDTASM+ ROM Pak.

80: Starting address of $4000, change to suit your needs.

100-130: The address of four ROM subroutines. $A928 clears the text screen and homes the cursor, $A1C1 gets the key pressed, $A30A prints to the text screen, $A2BF prints to the printer.

190-210: Clears the text screen, displays title and requests starting page number.

230-280: The keyboard is polled to get the page number. If valid, the number is stored in multipurpose register COUNT1 as an ASCII value.

300-340: The page number is displayed and the background color is requested.

360-400: The keyboard entry is obtained; if 0, it is stored in BKGND, otherwise 1 is stored. By changing the background color, it is possible to obtain either positive or negative print-outs.

420-460: The background is displayed and the "printer ready" prompt appears.

480-500: After the printer is set-up, it is initialized by the contents of string PRTINT. This string puts the printer on-line, sets compressed printing, sets eight per inch, sets page length to 88 lines, sets top-of-form and lastly advances the paper eight lines.

520-540: The number of lines to be printed, 64, is stored in LINES.

560-620: The first graphics byte is found by initially loading the X-register with $600. Then for each additional page, $600 is added to X. The X-register will now keep track of the 6144 bytes required to store the PMODE4 screen.

640-650: The Y-register is loaded with the address of the print string,

```
                    00010 ***************
                    00020 *PMODE 4 PRINT*
                    00030 ***************
                    00040 *
                    00050 *J.KOHN
                    00060 *10NOV82
                    00070 *
4000                00080          ORG $4000
                    00090 *
          A928      00100 CLRSCR   EQU $A928       CLEAR SCREEN AND HOME CURSOR
          A1C1      00110 POLCAT   EQU $A1C1       KEYBOARD CHARACTER TO REGISTER A
          A30A      00120 PRTSCR   EQU $A30A       PRINTS CHARACTER IN REGISTER A TO SCREEN
          A2BF      00130 PRTPRT   EQU $A2BF       PRINTS CHARACTER IN REGISTER A TO PRINTER
                    00150 *
                    00160 *WRITTEN IN POSITION INDEPENDENT CODE
                    00170 *FOR MICROLINE 82A IN 7-BIT MODE
                    00180 *
4000 BD   A928      00190 START    JSR CLRSCR      PRINT TITLE DISPLAY
4003 30   8D 0175   00200          LEAX TITLE,PCR
4007 17   012B      00210          LBSR SCRPRT
                    00220 *
400A 17   0132      00230          LBSR GETKEY     GET START PAGE
400D 81   36        00240          CMPA #'6
400F 24   EF        00250          BHS START
4011 81   30        00260          CMPA #'0
4013 23   EB        00270          BLS START
4015 A7   8D 02AC   00280          STA COUNT1,PCR  PAGE STORED IN COUNT1 AS ASCII
                    00290 *
4019 BD   A928      00300          JSR CLRSCR      DISPLAY PAGE NUMBER
401C 30   8D 0199   00310          LEAX PAGPRT,PCR
4020 17   0112      00320          LBSR SCRPRT
4023 A6   8D 029E   00330          LDA COUNT1,PCR
4027 B7   042B      00340          STA $400+43
                    00350 *
402A 17   0112      00360          LBSR GETKEY     GET BACKGROUND COLOR
402D 81   30        00370          CMPA #'0
402F 27   02        00380          BEQ AA
4031 86   31        00390          LDA #'1         SET BACKGROUND TO '1
4033 A7   8D 0293   00400 AA       STA BKGND,PCR   SET BACKGROUND TO '0
                    00410 *
4037 BD   A928      00420          JSR CLRSCR      DISPLAY BACKGROUND
403A 30   8D 01B8   00430          LEAX BKPRT,PCR
403E 17   00F4      00440          LBSR SCRPRT
4041 A6   8D 0285   00450          LDA BKGND,PCR
4045 B7   042B      00460          STA $400+43
                    00470 *
4048 17   00F4      00480          LBSR GETKEY     PROMPT PRINTER
404B 31   8D 01C8   00490          LEAY PRTINT,PCR
404F 17   00F3      00500          LBSR PNTPRT
                    00510 *
4052 BD   A928      00520          JSR CLRSCR
4055 C6   40        00530          LDB #64
4057 E7   8D 026E   00540          STB LINES,PCR
                    00550 *
405B A6   8D 0266   00560          LDA COUNT1,PCR  GET START PMODE BYTE
405F 80   30        00570          SUBA #48        CONVERT FROM ASCII
4061 8E   0600      00580          LDX #$600
4064 4A             00590 FF       DECA
4065 27   06        00600          BEQ STSTR
4067 30   89 0600   00610          LEAX $600,X     X HAS PMODE BYTE ADDRESS
406B 20   F7        00620          BRA FF
                    00630 *
406D 31   8D 01C0   00640 STSTR    LEAY PRTBLK,PCR Y HAS CHARACTER BYTE ADDRESS
4071 6F   8D 0253   00650          CLR BYTES,PCR
                    00660 *
4075 C6   40        00670 INIT     LDB #64         INITIALIZE CHARACTER BYTES
4077 86   80        00680          LDA #128
4079 E7   A0        00690 XX       STB ,Y+
407B 4A             00700          DECA
407C 26   FB        00710          BNE XX
407E 31   8D 01AF   00720          LEAY PRTBLK,PCR
```

```
                    00730 *
4082 C6    01       00740          LDB #1           TOP CHARACTER ROW CONSTANTS
4084 E7    8D 023D  00750          STB COUNT1,PCR
4088 58             00760          LSLB
4089 E7    8D 0239  00770          STB COUNT2,PCR
                    00780 *
408D A6    80       00790 STBYT    LDA ,X+          GET PMODE BYTE
408F E6    8D 0237  00800          LDB BKGND,PCR
4093 C1    30       00810          CMPB #'0
4095 27    01       00820          BEQ YY
4097 43             00830          COMA             COMPLEMENT IF BACKGROUND IS '1
                    00840 *
4098 17    00CB     00850 YY       LBSR PRTCHR
409B 6C    8D 0229  00860          INC BYTES,PCR
409F E6    8D 0225  00870          LDB BYTES,PCR
40A3 C1    60       00880          CMPB #96
40A5 27    2D       00890          BEQ LL
40A7 C1    40       00900          CMPB #64
40A9 22    E2       00910          BHI STBYT
40AB 27    19       00920          BEQ NN
40AD C1    20       00930          CMPB #32
40AF 22    DC       00940          BHI STBYT
40B1 27    02       00950          BEQ QQ
40B3 20    D8       00960          BRA STBYT
                    00970 *
40B5 C6    04       00980 QQ       LDB #4           MIDDLE CHARACTER ROW CONSTANTS
40B7 E7    8D 020A  00990          STB COUNT1,PCR
40BB 58             01000          LSLB
40BC E7    8D 0206  01010          STB COUNT2,PCR
40C0 31    8D 016D  01020 RR       LEAY PRTBLK,PCR
40C4 20    C7       01030          BRA STBYT
                    01040 *
40C6 C6    10       01050 NN       LDB #16          BOTTOM CHARACTER ROW CONSTANTS
40C8 E7    8D 01F9  01060          STB COUNT1,PCR
40CC C6    E0       01070          LDB #-32
40CE E7    8D 01F4  01080          STB COUNT2,PCR
40D2 20    EC       01090          BRA RR
                    01100 *
40D4 31    8D 0159  01110 LL       LEAY PRTBLK,PCR FIND NON-BLANK CHARACTERS
40D8 6F    8D 01E9  01120          CLR COUNT1,PCR
40DC 86    80       01130          LDA #128
40DE E6    A0       01140 MM       LDB ,Y+
40E0 C1    40       01150          CMPB #64
40E2 27    04       01160          BEQ ZZ
40E4 6C    8D 01DD  01170          INC COUNT1,PCR
40E8 4A             01180 ZZ       DECA
40E9 26    F3       01190          BNE MM
40EB 31    8D 013C  01200          LEAY PRTSTR,PCR PRINT CHARACTER STRING
40EF 8D    54       01210          BSR PNTPRT
40F1 31    8D 013C  01220          LEAY PRTBLK,PCR
40F5 A6    A0       01230 SS       LDA ,Y+
40F7 81    40       01240          CMPA #64
40F9 27    04       01250          BEQ PP
40FB 6A    8D 01C6  01260          DEC COUNT1,PCR
40FF BD    A2BF     01270 PP       JSR PRTPRT
4102 6D    8D 01BF  01280          TST COUNT1,PCR
4106 26    ED       01290          BNE SS
4108 86    0F       01300          LDA #15
410A BD    A2BF     01310          JSR PRTPRT
410D 86    0D       01320          LDA #13
410F BD    A2BF     01330          JSR PRTPRT
4112 6A    8D 01B3  01340          DEC LINES,PCR   SEE IF SCREEN FINISHED
4116 1026 FF53      01350          LBNE STSTR
                    01360 *
411A 86    0C       01370          LDA #12
411C BD    A2BF     01380          JSR PRTPRT
411F 86    0D       01390          LDA #13
4121 BD    A2BF     01400          JSR PRTPRT
4124 30    8D 0189  01410          LEAX REPEAT,PCR PROMPT REPEAT
4128 8D    0B       01420          BSR SCRPRT
412A 8D    13       01430          BSR GETKEY
412C 81    59       01440          CMPA #'Y
412E 1027 FECE      01450          LBEQ START
```

PRTBLK, which is 128 bytes of reserved memory. The BYTES register is cleared. This register will track the number of graphics bytes used for compiling each string.

670-720: PRTBLK is initialized to 64 which is the 'off' or 'no print' state indicated by Figure 1a.

740-770: To prepare for compiling the top pixel row, 1 is loaded into COUNT1 and 2 into COUNT2. These are the contants shown in Figure 1.

790-830: The graphics byte, pointed to by X, is loaded into the A-register, where it is complemented if the background is 1.

850: The byte is translated into six-block weight by PRTCHR (lines 1780-1850). This subroutine in turn uses BYTBIT, which shifts out each bit and uses the appropriate six-block values from COUNT1 and COUNT2. The rest of PRTCHR checks to see if all 8 bits of the graphics byte have been processed.

860-960: The number of bytes processed for the string are checked. If 32, the middle row weights are stored in COUNT1 and COUNT2, then branch back to STBYT. A similar process is done after 64 bytes for the bottom row. After compiling all 96 bytes, the string is complete and almost ready for printing.

1110-1190: To speed up printing, a look-ahead is used. This is simply counting the number of blanks (value 64) in PRTBLK and storing in COUNT1.

1200-1270: Four spaces and the six-block shift-in function, PRTSTR, are sent to the printer. The four spaces center the image. The print string PRTBLK is then sent, while keeping track of the number of blanks sent by decrementing COUNT1.

1280-1330: If the number of blanks sent equals the number in the string, COUNT1 is zero and the line is finished by the six-block shift-out function and carriage return.

1340-1400: LINES is decremented. If less than 64 lines have been printed, a branch is taken back to STSTR for the next line. Otherwise, the printout is finished with a formfeed to the bottom of the page.

1410-1460: The 'repeat' prompt is displayed.

To use the program with the 8-bit printer mode, do the following: change 64 to 128 in lines 670, 1150 and 1240; delete the minus in line 1070.

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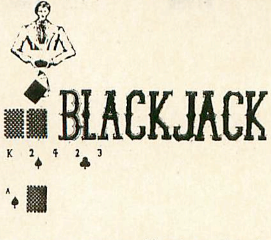

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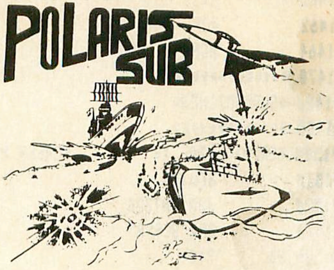

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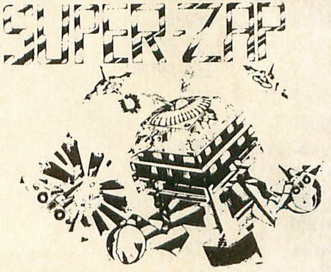

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```
4132 39             01460        RTS
4133 12             01462        NOP
4134 12             01464        NOP
                    01470 *************
                    01480 *SUBROUTINES*
                    01490 *************
4135 A6   80        01500 SCRPRT  LDA ,X+          SCREEN PRINT
4137 27   05        01510         BEQ BB
4139 BD   A30A      01520         JSR PRTSCR
413C 20   F7        01530         BRA SCRPRT
413E 39             01540 BB      RTS
                    01550 *
413F BD   A1C1      01560 GETKEY  JSR POLCAT       KEYBOARD
4142 27   FB        01570         BEQ GETKEY
4144 39             01580         RTS
                    01590 *
4145 A6   A0        01600 PNTPRT  LDA ,Y+          PRINTER PRINT
4147 27   05        01610         BEQ DD
4149 BD   A2BF      01620         JSR PRTPRT
414C 20   F7        01630         BRA PNTPRT
414E 39             01640 DD      RTS
                    01650 *
414F 48             01660 BYTBIT  LSLA
4150 24   08        01670         BCC GG
4152 E6   A4        01680         LDB ,Y
4154 EB   8D 016D   01690         ADDB COUNT1,PCR
4158 E7   A4        01700         STB ,Y
415A 48             01710 GG      LSLA
415B 24   08        01720         BCC HH
415D E6   A4        01730         LDB ,Y
415F EB   8D 0163   01740         ADDB COUNT2,PCR
4163 E7   A4        01750         STB ,Y
4165 39             01760 HH      RTS
```

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```
                    01770 *
4166 6F   8D 015D   01780 PRTCHR  CLR BITS,PCR
416A 17   FFE2      01790 EE      LBSR BYTBIT
416D 31   21        01800         LEAY 1,Y
416F 6C   8D 0154   01810         INC BITS,PCR     SEE IF 8 BITS DONE
4173 E6   8D 0150   01820         LDB BITS,PCR
4177 C1   04        01830         CMPB #4
4179 26   EF        01840         BNE EE
417B 39             01850         RTS
                    01860 *
                    01870 *
                    01880 *
                    01890 ***************
                    01900 *PRINT STRINGS*
                    01910 ***************
417C      0D0D      01920 TI1LE   FDB $0D0D
417E      0D        01930         FCB 13
417F      20        01940         FCC /        *PMODE 4 PRINT*/
          20
          20
          20
          20
          20
          20
          20
          20
          2A
          50
          4D
          4F
          44
          45
          20
          34
          20
          50
          52
          49
          4E
          54
          2A
4197      0D        01950         FCB 13
4198      0D        01960         FCB 13
4199      0D0D      01970         FDB $0D0D
419B      53        01980         FCC /START PAGE NUMBER (1 TO 5)?/
          54
          41
          52
          54
          20
          50
          41
          47
          45
          20
          4E
          55
          4D
          42
          45
          52
          20
          28
          31
          20
          54
          4F
          20
          35
          29
          3F
41B6      0D0D      01990         FDB. $0D0D
```

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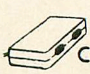
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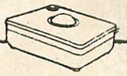

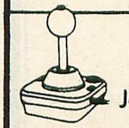
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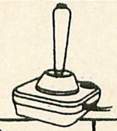
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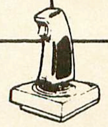
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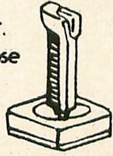

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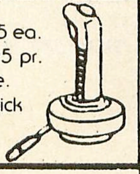

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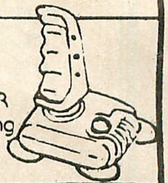

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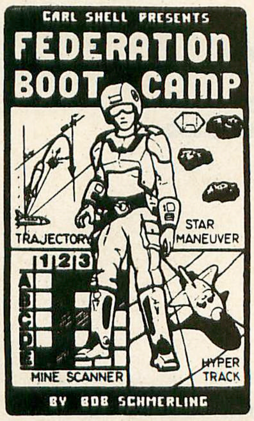

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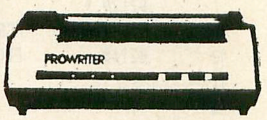

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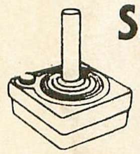

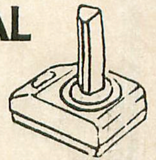

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```
41B8     00       02000          FCB 0
                  02010 *
41B9     0D       02020 PAGPRT   FCB 13
41BA     53       02030          FCC /START PAGE=/
         54
         41
         52
         54
         41
         52
         54
         20
         50
         41
         47
         45
         3D
41C5     0D0D     02040          FDB $0D0D
41C7     0D       02050          FCB 13
41C8     42       02060          FCC /BACKGROUND (0 OR 1)?/
         41
         43
         4B
         47
         52
         4F
         55
         4E
         44
         20
         28
         30
         20
         4F
         52
         20
         31
         29
         3F
41DC     0D       02070          FCB 13
41DD     30       02080          FCC /0=BLACK/
         3D
         42
         4C
         41
         43
         4B
41E4     0D       02090          FCB 13
41E5     31       02100          FCC /1=BUFF OR GREEN/
         3D
         42
         55
         46
         46
         20
         4F
         52
         20
         47
         52
         45
         45
         4E
41F4     0D00     02110          FDB $0D00
                  02120 *
41F6     0D       02130 BKPRT    FCB 13
41F7     42       02140          FCC /BACKGROUND=/
         41
         43
         4B
         47
         52
         4F
         55
         4E
         44
         3D
4202     0D0D     02150          FDB $0D0D
4204     0D       02160          FCB 13
4205     52       02170          FCC /READY PRINTER.../
         45
         41
         44
         59
         20
         50
         52
         49
         4E
         54
         45
         52
         2E
         2E
         2E
4215     0D00     02180          FDB $0D00
                  02190 *
4217     11       02200 PRTINT   FCB 17          INITIALIZES PRINTER
4218     1B       02210          FCB 27
4219     41       02220          FCB 'A
421A     1D       02230          FCB 29
421B     1B       02240          FCB 27
421C     38       02250          FCB '8
421D     0D       02260          FCB 13
421E     1B       02270          FCB 27
421F     46       02280          FCB 'F
4220     38       02290          FCB '8
4221     38       02300          FCB '8
4222     1B       02310          FCB 27
```

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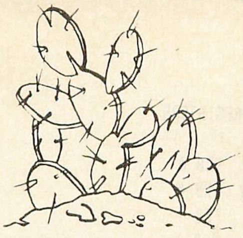

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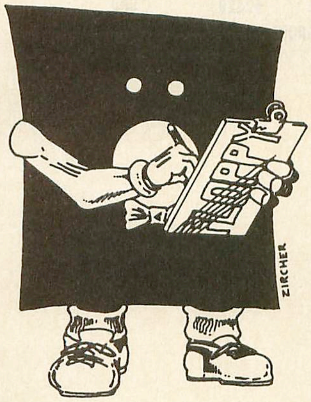

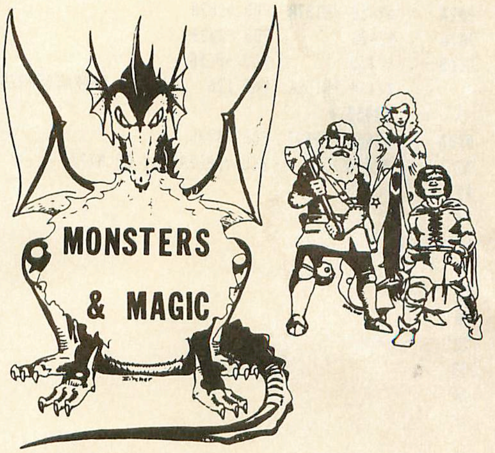

The Disk Manager

If you use a disk drive you NEED this program! It does more than any other disk utility. You can use it to rebuild a crashed disk easily - two different ways. You can also print a SUPER DIRECTORY for a disk that contains such information as program size, which granules are used, and the start, end, and execute addresses for machine language programs. It will also print a menu on the screen for a disk in the drive, and when you indicate your choice it will load and either RUN or EXEC the program for you as appropriate. In addition, it codes your files by DATE, and it codes your disks by NAME and NUMBER. And, it creates and maintains a file of all your disks (and the programs on them) which you can sort and print as needed. You can sort a collection of up to 300 disks. Could you use a printed list of EVERY program in your collection, in alphabetical order? This list tells you which disk has the program you need so you can find it easily, and all this is only the beginning. There are so many features we have no space to mention them all. Both the 16K and 32K versions are included, and we suggest you place a copy of the program on every diskette for quick access. You will wonder how you got along without this beauty!! Full, easy to follow instructions. Requires a disk drive. **$29.95**

The Disk Master

This helpful addition to your library performs a whole list of great functions. We've seen programs selling for just as much that do only one or two of these things, and the whole thing is menu driven for ease of use. It provides a speed check and adjustment function to get your drives into perfect adjustment. It moves data files from tape to disk — or disk to tape — or programs from one drive to another — all effortlessly. It prints a directory — with machine language addresses — to the screen or printer. It gives you two different disk maps. One shows which sectors are used in each gran, and the other shows which grans are available. It even gives you a way to easily purge *a number of files* from a crowded disk. Why buy a different program for every function, when this does so much? Requires a disk drive. **$24.95**

Monsters & Magic

The most realistic fantasy role-playing game yet for the Color Computer. You start out by rolling up your character's basic ability scores and buying equipment. When you are ready it's into the dungeon. Your character starts at first level, but can rise in levels by garnering experience in the fray. If you have role-played fantasy games you will be amazed at the realism of the combat system. Armor class, initiative, and damage by weapon type are all included, with over 50 different monsters to fight - each with it's own abilities. As you rise in level you can win treasure and find magic weapons and spells - if you live!! You set the game length by telling how many monsters you want to fight before you reach your final battle to the death against the powerful Dungeon Lord. There are 1000+ place description combinations in this text based game, and real excitement in every one! This is a fantasy simulation, and is truly not like any adventure game you have ever seen. For 1 player; requires 32K extended BASIC. **TAPE - $19.95, DISK - $24.95**

Astrology

Truly a classic, this program will accurately cast your complete horoscope. You just enter the date, time, and place of birth. The sun sign, rising sign, mid heaven (MC), lunar nodes, and planetary influences including houses and aspects between the planets will all be calculated, and a full chart drawn. You can also do progressed charts and transits. It will even tell you the day of the week you were born. The accompanying book will help you interpret this chart of your horoscope. The extent of the documentation is tremendous, even by our exceptionally high standards, and no previous knowledge of the subject is required. You can share in this wisdom which has been used for thousands of years in many cultures. This program was written by a professional Astrologer. Please specify 16K or 32K system. **$34.95 tape — $39.95 disk**

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```
4223    35      02320           FCB '5
4224    0D      02330           FCB 13
4225    1B      02340           FCB 27
4226    0B      02350           FCB 11
4227    30      02360           FCB '0
4228    38      02370           FCB '8
4229    0D      02380           FCB 13
422A    00      02390           FCB 0
                02400 *
422B    2020    02410 PRTSTR  FDB $2020
422D    2020    02420         FDB $2020
422F    0E00    02430         FDB $0E00
4231            02440 PRTBLK  RMB 128          4 CHARACTERS/BYTE
                02450 *
42B1    0D0D    02460 REPEAT  FDB $0D0D
42B3    52      02470         FCC /REPEAT (Y OR N)?/
        45
        50
        45
        41
        54
        20
        28
        59
        20
        4F
        52
        20
        4E
        29
        3F
42C3    0D00    02480           FDB $0D00
                02490 *
                02500 *
```

```
                02510 *
                02520 *
                02530 *
                02540 *USER REGISTERS
                02550 *
42C5    00      02560 COUNT1  FCB 0
42C6    00      02570 COUNT2  FCB 0
42C7    00      02580 BITS    FCB 0
42C8    00      02590 BYTES   FCB 0
42C9    00      02600 LINES   FCB 0
42CA    00      02610 BKGND   FCB 0              BACKGROUND IN ASCII
        0000    02620         END
00000 TOTAL ERRORS

AA      4033
BB      413E
BITS    42C7
BKGND   42CA
BKPRT   41F6
BYTBIT  414F
BYTES   42C8
CLRSCR  A928
COUNT1  42C5
COUNT2  42C6
DD      414E
EE      416A
FF      4064
GETKEY  413F
GG      415A
HH      4165
INIT    4075
LINES   42C9
LL      40D4
MM      40DE
NN      40C6
PAGPRT  41B9
PNTPRT  4145
POLCAT  A1C1
PP      40FF
PRTBLK  4231
PRTCHR  4166
PRTINT  4217
PRTPRT  A2BF
PRTSCR  A30A
PRTSTR  422B
QQ      40B5
REPEAT  42B1
RR      40C0
SCRPRT  4135
SS      40F5
START   4000
STBYT   408D
STSTR   406D
TITLE   417C
XX      4079
YY      4098
ZZ      40E8
```

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Hint

Here's an easy way to end many tape I/O errors. Position tape where program is to be saved. Then press play and record, and type in *MOTOR ON*. Estimate the length of your program, add a few seconds more, and type *MOTOR OFF*. Rewind to original position, and save in normal way.

This will erase any unwanted junk on the tape, thus allowing a clean saving process.

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COLOR DFT (Direct File Transfer) Disk or Tape

At last a terminal program for the color computer that allows you to send and receive machine language programs without any conversion routines. Send directly from disk to disk or tape to disk. DFT will send and receive any type of program machine language, basic, text files, data files etc. from a color computer, Model I, Model II or a Bullet 80 system. DFT has a chat mode and has software controlled half and/or full duplex. You must have a modem in order to use DFT.

Tape Version .... **$24.95** Disk Version **$29.95**

COLOR TAPE COPY $15.95

By Bob Withers

There have been few copy programs on the market for the Color computer but none can compare with Color Tape Copy. This program is designed so that you don't lose any of your vaulable programs or data bases.

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You'll never have to worry about your little kids destroying your $20.00 tapes. 16K.

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Best word processor for the Color Computer.

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By Rodney Zaks & William Labiak **$14.95**

This book explains how to program the 6809 in assembly language, covering all aspects progressively and systematically. Beginning with the basics of programming, **Programming the 6809** goes on to explain registers and buses, subroutines, the 6809 instruction set, addressing modes, I/O techniques and devices, and finally, data structures. With this knowledge you will be able to give your 6809 processor 16-bit performance with 8-bit economy. No prior programming knowlede is required.

TRS-80 COLOR PROGRAMS

by Tom Rugg and Phil Feldman **$19.95**

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by Ron Clark **$9.95**

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TRS-80 COLOR BASIC

by Bob Albrecht **$9.95**

With this book you can teach yourself BASIC, the language of the TRS-80 and many other computers. Packed with games, experiments, programming problems and solutions, this entertaining self-instructional book is the ideal introductory aid for kids, parents and teachers. 378 pages.

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by Don Inman **$14.95**

Explore the creative and imaginative blending of computers and color using Color Computer Graphics. This book will enable you to explore all the graphics capabilities of Extended Basic. you will learn how to create interesting graphics to enhance you own computer programs. The book also provides application programs and useful subroutines. 303 pages

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PRINT #-2,

(continued from page 13)

regular basis. If so, we would have to increase prices a little (the record is very expensive). So, I'd like to know whether you think it would be worth a price increase. If there is one, we would probably go with a "longer" record, one which would contain more programs. Do, please, follow the instructions carefully in interfacing the programs on the record to your CoCo.

There are some other neat things in here this month, too. I don't want to steal Jim Reed's thunder from his preview of the issue, but I would like to answer one question someone asked me at RAINBOWfest. The question was, "How do you come up with so much for everyone each month?"

The answer is pretty simple: We are by far the largest Color Computer magazine, both in terms of circulation (now over 50,000 paid) and in terms of pages. You've heard me say that we appreciate your mentioning us when you order or make inquiry about products advertised in these pages, and, from what our advertisers say, you do. We thank you for that—but thank yourselves as well. As long as we continue to be the leader in the field, we can continue to expand—offering more programs, more information and more features than anyone else. Last month's *Rainbow* weighed well over a pound. That's a lot of material but, after all, CoCo is a lot of computer.

A year ago this time, I wrote about a whole lot of people who helped us grow. The list, too, has grown. We were 64 pages last July and this month we should be right at or over 300. That sure doesn't happen by magic.

Right here at home, it would never have been possible without Pat Hirsch. Pat is Mrs. Everything around here. I'm proud she's a part of it all.

Ivanka Kleier, "Mrs. Ivanka," and her staff of Tanya Holder and Deidra Henry, make the subscriptions work. Even the day we had 465 new subscribers hit the mailbox at once didn't daunt this crew. They are efficiency personified. And, similarly, Monica Wheat, who gets things out when they should be. That's grown to be a pretty big job—and Monica does it well.

All that pretty stuff you see in *the Rainbow* comes from the talent of Sally Nichols and Jerry McKiernan, with some help from Meri May. But, more than that, they also get things together—and if you don't think laying out 300-some pages every month is a massive job, please think again. And hey, you folks are lucky, you have *Rainbow On Tape*. But every word in this magazine has to be typed by Suzanne Kurowsky and Valarie Edwards. That's a big job!

Your first contact with *the Rainbow*, whether you call, write or walk right in, is likely to be Penny Tabor, our receptionist, and she makes those first impressions count. Keeping count of the avalanche of program and article submissions, our product reviews and *Rainbow* Scoreboard is Jutta Kapfhammer, who keeps her desk amazingly straight despite the ton of material that crosses it.

Donna Shuck keeps the books straight. No easy feat at all. Donna is sort of new to *the Rainbow*, but she's worth her weight in pizza.

Wry Courtney Noe and Jim "J.R." Reed are the backbone of the editorial operation. They have various nicknames —from the "Dynamic Duo" to the "Odd Couple." What both are is indispensable. Period.

Willo, Wendy and Laurie—long-suffering family. Thank you for putting up with all of this. To say that it has been interesting would probably be an understatement. But, for all the nights when I had to work, for all the weekends when I just went in "for an hour," for the parties I didn't go to and the driving I couldn't do, thanks for understanding.

When you get involved with something like this, you make a lot of friends. Our contributing editors are not just associates, they are friends, too. So, thank you Bob Albrecht, Steve (and Cheryl) Blyn, Don Inman, Joe Kolar, Dennis (and Rose) Lewandowski, Charlie Roslund, Tony DiStefano, Bill (and Sara) Nolan and Dick White. A great bunch of people.

There really are so many people who are part of the CoCo Community: Paul Rosen, Sue and Paul Searby, John Fraysee, Fred Crawford, Ron and Mona Krebs, Ted Donhauser, Robert Frowenfeld, Dick Hatcher, Bill Vergona, Dave Lagerquist, Dan Downard and the "Green People," Frank Brandon, Jack Torres, Gordon Monnier, Geoff Wells, Tom Delker, Ira Bass, John Waclo, Guy Endicott, Jay Hoggins, Fred Scerbo, Sandy Trevor, Roger Schrag, Ted Hasenstaub, Larry Preble, Tom Scott, Tom Mix, John and Linda Nielson, Paul Nanos, Dan and Tom Nelson, Kathy Goebel, Wayne Diercks, Vic Andrews, Arnold Weiss, Pete Stark, Sue and Gary Davis, Bill Dye, Ed Pollard, Tom Rosenbaum, Jan Zucker, John Boals, Don Dollberg, Tom Kelly, the Delbourgo family,

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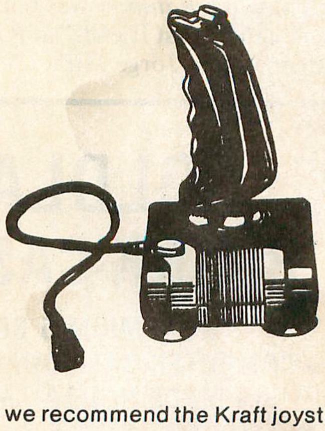
QUICK SHOT JOYSTICKS



We have tested many joysticks in the last few months and we feel that we have found a winner in the new QuickShot joystick by Spectravision. It has a contour design that fits comfortably around your palm. You can play for hours without developing a case of sore thumb. It has two fire buttons one on the base, and one on the handle for that extra margin of speed. It has four suction cups on the base and comes with a long cord. The best part of it is that it is only **$14.95.** This is an Atari compatible joystick and must have a converter. Atari type joysticks work well with most games but there are some they won't work on. For these we recommend the Kraft joystick.

WICO CONVERTER - Converts two Atari type joysticks to the COCO for only **$17.95**

KRAFT JOYSTICK

For those that want a full analog joystick we recommend the Kraft joystick. This stick is light enough to be held in your hand yet strong enough to be guaranteed for a full year. This is my favorite joystick. List price is $64.95 but we sell them for only **$49.95.**

OTHER JOYSTICKS!

Wico Red Ball	**$34.95**
Wico Arcade joysticks	**$29.95**
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Harold Berkeley, Frank Hogg and others truly too numerous to mention, such as all our reader reviewers who write for *the Rainbow* each month.

Oh, the three who once got on CompuServe and decided someone should write up some notes on the Color Computer. That's how *the Rainbow* was born. What a thrill to have all three of those "first friends" at RAINBOWfest: Bob Rosen, Joe Bennett and Jorge Mir!

And, in all of this, I must inject a note of sadness for one person I never had the pleasure of meeting. Arnold Pouch, who left us this past year, would, I know, have been among those at RAINBOWfest and would have shared the joy and CoCo Community to its utmost.

It would be wholly inappropriate to write thanks without thanking those who *really* made all this possible—the fine folks at Radio Shack who are the guiding hands behind the Color Computer. To Jon Shirley, Ed Juge and Barry Thompson, a large measure of thanks from thousands of us who deeply appreciate your creating and supporting the best computer available at the most attractive price anywhere.

Last and certainly not least: Each of you. Your support for *the Rainbow* has been tremendous, your devotion and suggestions, your letters and cards, your phone calls and your willingness to be a part of the CoCo Community has been, by far, the most heartening and the most important of all.

Thank you for sharing with us and thank you for allowing us to be a part of your lives. We look forward to your continued interest, sharing and support for our CoCo Community in the years ahead.

—Lonnie Falk

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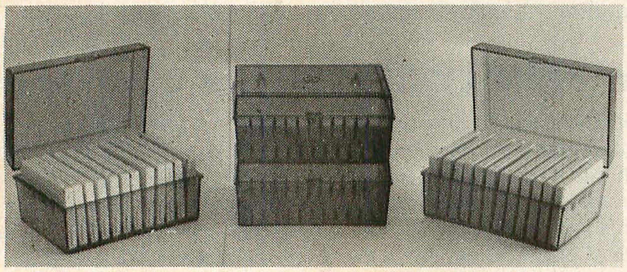

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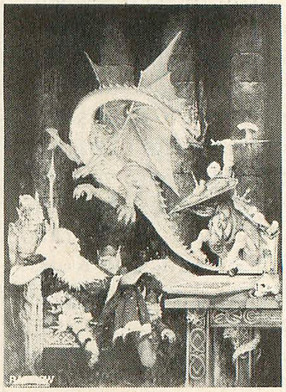

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A CHEAP TALKER FOR OUR COCO

By John R. Kelty

With a device I call the *Cheap Talker*, you can get your CoCo to talk. *Cheap Talker* is simply a cartridge that plugs into the CoCo "expansion" slot and allows you to program speech that will come from your TV speaker. This is not a ROM or a software generated speech system. It is a hardware circuit based primarily on an integrated circuit (IC) called the Votrax SC-01 Speech Synthesizer. Unfortunately, the cost of this chip is still high (the Micromint sells them for $50 in single quantities), but keeps coming down (they were $75 only six months ago). The rest of the components might cost you $20 to $30 depending on your construction. The *Cheap Talker* requires only two ICs and a transistor with a few resistors and capacitors placed on an edge connector type circuit board. You can use any of several experimenter type circuit boards such as the new Radio Shack catalog number 276-163, but a printed circuit board is available. The software is simply a BASIC program and is stored on cassette. Just plug in the cartridge, turn on the computer, load and run the program, and listen to your TV say "I am the Color Computer Talker" followed by the ABCs.

The Votrax (Votrax is a division of Federal Screw Works) SC-01 speech synthesizer is the descendent of a complicated multiboard circuit costing several thousands of dollars only 10 years ago. The new CMOS IC represents a good mixture of analog and digital circuitry and is easily interfaced to just about any computer. In fact, one of the projects that I have about halfway finished is a talking bulletin board, the size of a picture frame, using the Timex Sinclair Computer. After trying to figure some of the things going on in there, I give Radio Shack four stars for the design and support of the CoCo! In any case, the Votrax IC is complicated but easy to use.

Some of the features of the Votrax SC-01 include 64 programming input codes (6 bits), four programmable pitch levels (2 bits), provisions for manually adjusting the pitch, TTL compatible inputs, strobe and acknowledge handshaking lines, and easy analog output drive connections. Of the 64 programming codes, 61 are actually *phonemes*, two are different durations of "no sound," and one is a Stop code. Speech is synthesized using phonemes to build words (such as T-AW-K-ER for "talker" with a Midwest drawl). The IC is a 22-pin plastic DIP and I have handled them without any problems due to static electricity, etc. Good things do come in small packages!

The only other IC required for this project is a peripheral interface adapter (PIA). I chose the Motorola 6821PIA for several reasons, including cost, relative ease of programming, durability and familiarity. Since the 6821PIA (and now the 6822 CMOS look alike) are included in the design of the Radio Shack Color Computer, I also thought it might be the best choice for most CoCo users. Other interface chips are certainly available. I have used the 6522VIA (Versatile Interface Adapter) and the 8255PPI (Programmable Peripheral Interface) successfully in a similar design to the one given here. Incidentally, the 6522VIA is a very popular IC that you will find in PET and VIC computers, among others.

> *"The Votrax . . . SC-01 speech synthesizer is the descendant of a complicated multiboard circuit costing several thousands of dollars only 10 years ago."*

The Votrax SC-01 is powered with 12 VDC in this circuit. The phonemes are programmed into the SC-01 with 6-bit codes from the 6821 port A. The inflection lines are also from port A, so that port A of the 6821 is always used as an output. When I was first experimenting with these inflection outputs, I simply did not use them and connected them to ground. I then used a 7416 open collector TTL buffer (see figure) since I was not sure of the inflection input compatibility with TTL levels. I now have them connected directly to the 6821 port A lines (and have also successfully connected them directly to other PIA outputs) with no problems. Since the 6821 Chip Select (pin 23, CS2*) is connected to the

---

(Mr. Kelty is the Electronics Shop Supervisor for the University of Nebraska-Lincoln Department of Physics and Astronomy and holds a master's degree in electrical engineering.)

CoCo SCS* (connector pin 36), the four register addresses of the 6821 will be:

65344	Port A and Port A data direction register
65345	Control Register A
65346	Port B and Port B data direction register
65347	Control Register B

Port B, CB1, and CB2 are not used. I set A=65344 and count from there in the program. The 6821 initialization is detailed below:

POKE A+1,0	Control reg sets up register A as a data direction register
POKE A,255	Port A data direction set for all 8 bits as outputs
POKE A+1,52	Reset reg A as port A and use CA1 and CA2 as control lines

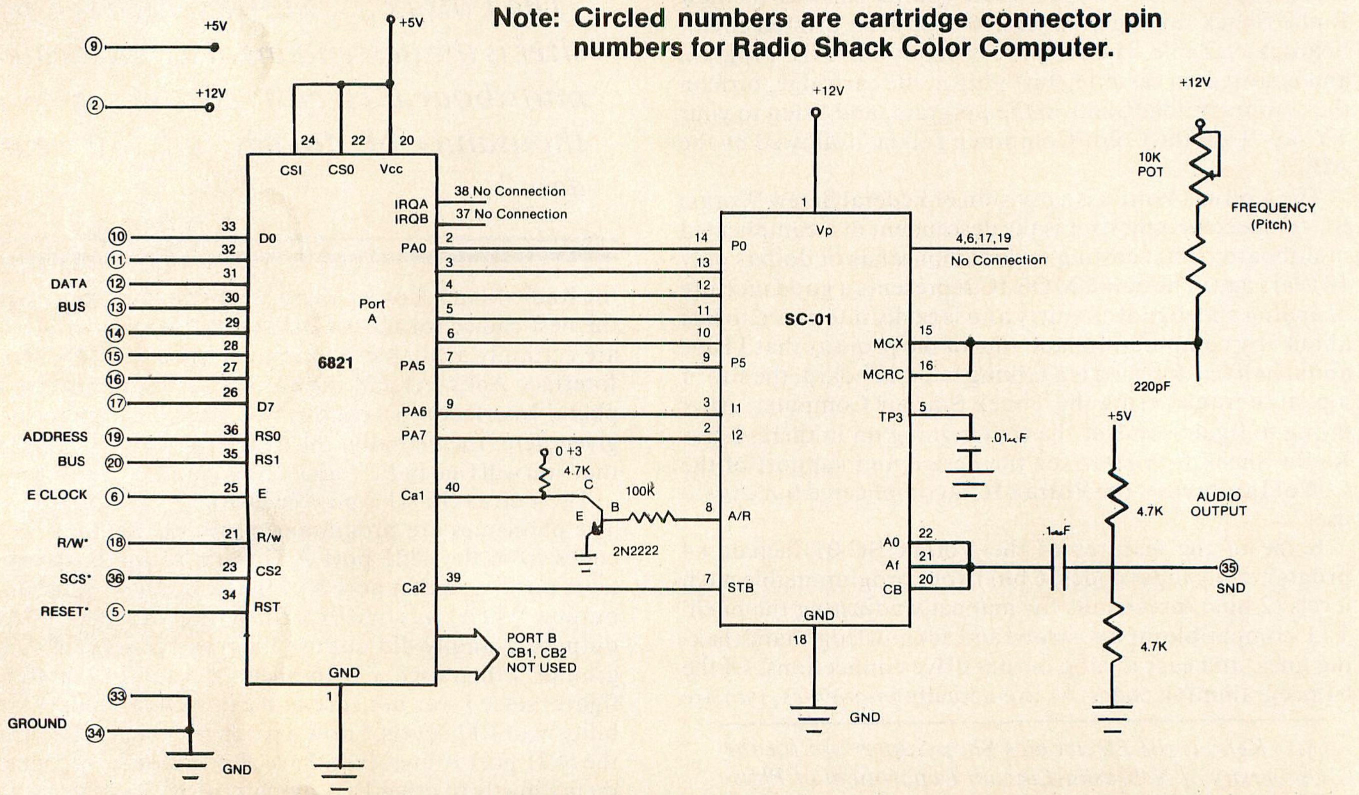
Similarly, the 6821s of the CoCo are programmed (addresses 65821 through 65823 and 65312 through 65315) to enable the CoCo sound multiplexer input from the cartridge.

The two control lines from the 6821 PIA provide the necessary handshake with the SC-01 for continous speech. The rising edge of the Strobe (STB) latches the six-bit phoneme data code. The data and strobe lines are directly connected to the 6821 since they are TTL compatible. The Acknowledge/Request (A/R) is essentially a CMOS output and is buffered with a simple transistor circuit. Note that this transistor inverts the logic of the original A/R output. When the SC-01 A/R signal goes from low to high (6821 input goes from high to low due to the transistor inversion), the old phoneme has timed out and a new phoneme data code may be latched into the SC-01.

The audio output is fed through the cartridge sound pin (35) to the Color Computer and out to your TV. The sound multiplexer IC in the CoCo is selected during the initialization. The output voltage from the SC-01 should be a maximum of approximately 3 Volts peak-to-peak for the AH phoneme and is sufficiently large enough for good volume control. The sound input to the CoCo should not exceed 5 Volts peak-to-peak in case you want to add a gain control amplifier (I have used a 741 op-amp but find it unnecessary. Remember that the volume can be controlled at your TV set!). An amplifier such as the LM386 might easily be added if a separate external speaker is desired, but I have not tested this.

The BASIC program sets up the 6821PIA, selects the cartridge sound input, and then outputs a Stop code (63) to the SC-01 (to keep it quiet). Then the sign-on message is read (and spoken) leaving the user to create speech with phonemes, separated by commas or spaces, in a string. Since this program is intended only for demonstration and experimentation, a string of phonemes should be long enough to say a few words and test the *Cheap Talker*. Vary the frequency control to manually change the voice pitch and if you connected the inflection inputs, IN0 through IN3 will add the proper bit values to port A so that you can program the four internal voice ptich levels.

I am working on a text-to-speech algorithm and writing a BASIC program for this (a machine language version would be nice, but will have to wait). It is not an easy task. It is easy, however, to generate phrases using data statements similar to those used for my sign-on message. A table of the alphabet with a few common words that may prove useful is provided. My two-year old daughter easily recites the ABCs



Note: Circled numbers are cartridge connector pin numbers for Radio Shack Color Computer.

+5V
⑨
+12V
②
+5V
24
22
20
CSI
CS0
Vcc
6821
DATA BUS
⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰
33 32 31 30 29 28 27 26
D0
D7
ADDRESS BUS
⑲ ⑳
36 35
RS0
RS1
E CLOCK ⑥
25
E
R/W* ⑱
21
R/w
SCS* ㊱
23
CS2
RESET* ⑤
34
RST
IRQA
IRQB
38 No Connection
37 No Connection
PA0
Port A
PA5
PA6
PA7
2 3 4 5 6 7 9
Ca1
40
Ca2
39
PORT B CB1, CB2 NOT USED
GND
1
GROUND
㉝
㉞
GND
0 +3
4.7K
C
E
B
100K
2N2222
+12V
1
Vp
SC-01
14 13 12 11 10 9
P0
P5
3 2
I1
I2
8
A/R
7
STB
4,6,17,19 No Connection
15
MCX
16
MCRC
5
TP3
.01µF
22 21 20
A0
A1
CB
GND
18
GND
+12V
10K POT
FREQUENCY (Pitch)
220pF
+5V
4.7K
AUDIO OUTPUT
.1µF
㉟
SND
4.7K

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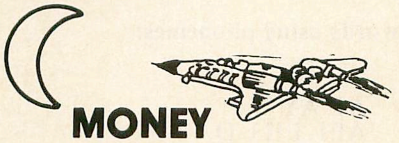

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TOWER OF FEAR

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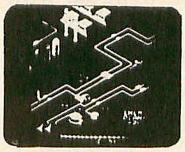

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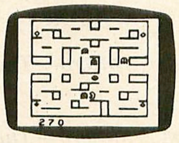

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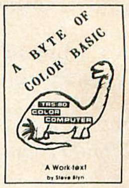

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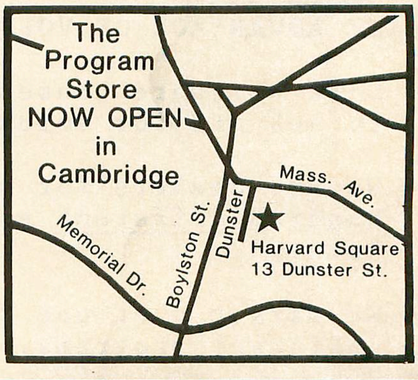
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along with the computer and imitates just about anything I can think of for speech programs. For Halloween, we had a talking, animated pumpkin. I have experimented with a singing synthesizer (*Son of Cheap Talker?*), but the complications are many due to the relative pitches involved with musical scales. A listing of "Daisy" was generated, but resembled HAL, of 2001, near death! Speech synthesis can be fun and rewarding as well as inexpensive with the Radio Shack Color Computer and *Cheap Talker.*

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The Micromint Inc., 917 Midway, Woodmere, NY 11598. 800-645-3497 Votrax SC-01A voice-synthesis integrated circuit...$50 each.

The Micro Works, P.O. Box 1110 Del Mar, CA 92014. 619-942-2400 Plastic Rompack type cartridge. 3*4 size...$7 each. 4*4 size...$6.50 each.

Radio Shack Dual plug-in interface board, Cat. No. 276-163...$4.95 each.

ABCs and some words using phonemes:

A	A1 AY Y
ADD	AE1 EH3 D
B, BE	B E1 Y
BASIC	B A1 Y S I2 K
C, SEE, SEA	S E1 Y
D	D E1 Y
DATA	D A2 Y DT UH1
E	E1 Y
EIGHT	A2 AY Y T PAO
ELEVEN	E1 L EH V UH N
END	EH2 EH3 N D
F	EH1 EH2 F
FIVE	F AH1 E1 V
FOUR, FOR	F O R
G	D J E1 Y
GO	G O U1
H	A1 AY Y T CH
HELLO	A AE1 L O2 O1 U1
I, EYE	AH1 EH3 I3 Y
J	D J EH3 A1 AY Y
K	K EH3 A1 AY Y
L	EH1 EH3 UH3 L
M	EH1 EH2 M
N	EH1 EH2 N
NINE	N AH1 E1 N
NO	N O1 O2 U1
O	O2 O1 U1
ONE	W UH1 N
P	P E1 Y
Q	K Y1 IU U1 U1
R, ARE	AH1 UH2 ER
READY	R EH1 EH3 D Y
S	EH1 EH2 S
SEVEN	S EH V EH1 N
SIX	S I K S
STOP	S T AH1 UH3 P PAO
T	T E1 AY Y
TALKER	T AW K ER
THE	TH I3 E
TEN	T EH N
THREE	THV R E
TIME	T AH1 EH3 Y M
TWELVE	T W EH2 UH3 L V
TWO	T IU IU U
U, YOU	Y1 IU U1 U1
V	V E1 AY Y
VOLT	V O2 O2 L T
W	D UH1 B UH3 L Y1 IU U1
WRONG	R AW NG
X	EH1 EH2 K PAO S
Y	W AH1 EH3 I3 Y
YES	Y1 EH3 EH1 S
Z	Z E1 Y
ZERO	Z AY I1 R O1 U1

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
00	EH3	59	jacket
01	EH2	71	enlist
02	EH1	121	heavy
03	PA0	47	no sound
04	DT	47	butter
05	A2	71	made
06	A1	103	made
07	ZH	90	azure
08	AH2	71	honest
09	I3	55	inhibit
0A	I2	80	inhibit
0B	I1	121	inhibit
0C	M	103	mat
0D	N	80	sun
0E	B	71	bag
0F	V	71	van
10	CH*	71	chip
11	SH	121	shop
12	Z	71	zoo
13	AW1	146	lawful
14	NG	121	thing
15	AH1	146	father
16	OO1	103	looking
17	OO	185	book
18	L	103	land
19	K	80	trick
1A	J*	47	judge
1B	H	71	hello
1C	G	71	get
1D	F	103	fast
1E	D	55	paid
1F	S	90	pass

Phoneme Code	Phoneme Symbol	Duration (ms)	Example Word
20	A	185	day
21	AY	65	day
22	Y1	80	yard
23	UH3	47	mission
24	AH	250	mop
25	P	103	past
26	O	185	cold
27	I	185	pin
28	U	185	move
29	Y	103	any
2A	T	71	tap
2B	R	90	red
2C	E	185	meet
2D	W	80	win
2E	AE	185	dad
2F	AE1	103	after
30	AW2	90	salty
31	UH2	71	about
32	UH1	103	uncle
33	UH	185	cup
34	O2	80	for
35	O1	121	aboard
36	IU	59	you
37	U1	90	you
38	THV	80	the
39	TH	71	thin
3A	ER	146	bird
3B	EH	185	get
3C	E1	121	be
3D	AW	250	call
3E	PA1	185	no sound
3F	STOP	47	no sound

**T must precede CH to produce J sound.*
D must precede J to produce CH sound.

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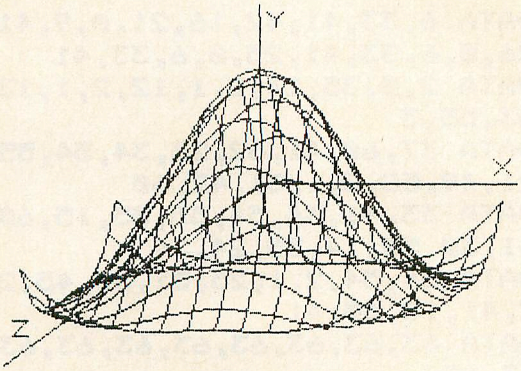

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```
260.... 031A
500.....0682
650.... 086E
880....0ABC
1320...0DC1
END... 100B
```

```
10 '****************************
20 'COLOR COMPUTER CHEAP TALKER
30 'JOHN R. KELTY
40 '1440 N 61ST LINCOLN,NE 68505
50 '(402)467-3298   HOME
60 '(402)472-2793   WORK
70 'FEB 23, 1983
80 '****************************
90 '
100 DIM Z(200):A=65344:CLS
110 IN=0:'INITIAL INFLECTION
120 'SET UP 6821 PIA
130 'PORT A, PA0-PA5, PHONEME 6-
BIT CODE TO SYNTHESIZER (OUTPUTS
)
140 'PORT A,PA6 AND PA7 ARE INFL
ECTION BITS
150 'I1 AND I2 RESPECTIVELY (OUT
PUTS)
160 POKEA+1,0:POKEA,255:POKEA+1,
52
170 'THE 6821 CONTROL REGISTER
180 '(FOR PORT A) BIT 7 IS SET
190 'BY A HIGH TO LOW CA1
200 'TRANSITION.  THIS GIVES THE
210 'PROPER HANDSHAKE LOGIC FOR
220 'THE A/R SIGNAL.
230 '
240 'ENABLE CC SOUND MUX INPUT F
ROM CARTRIDGE
250 POKE65281,180:POKE65283,61:P
OKE65315,60
260 '***************************
270 'SEND STOP PHONEME
280 P=63:GOSUB600
290 PRINT:PRINT"PHONEME STRING T
ALKER":PRINT
300 'DATA FOR SIGN-ON MESSAGE AN
D ABC'S.
310 'MESSAGE IS "HELLO, I AM THE
 COLOR COMPUTER CHEAP TALKER."
320 DATA 27,47,24,52,53,55,62,62
,21,0,9,47,0,12,12,56,60,60
330 DATA 25,25,21,24,58
340 DATA 25,25,50,49,12,37,34,54
,55,42,58
350 'ABC'S
360 DATA 42,16,60,60,37,3,42,61,
25,58,62,62,62
370 DATA 6,33,41,14,60,41,31,60,
41,30,60,41,60,41,2,1,29,30,26,6
0,41
380 DATA 6,33,41,42,16,21,0,9,41
,30,26,0,6,33,41,25,0,6,33,41
390 DATA 2,0,35,24,2,1,12,2,1,13
,52,53,55,3
400 DATA 37,60,41,62,25,34,54,55
,55,21,49,58,2,1,31,42,60
410 DATA 33,41,34,54,55,55,15,60
,33,41,30,50,14,35,24,34
420 DATA 54,54,2,1,25,31,31,45,2
1,0,9,41,18,60,41
430 DATA 63,63,63,63,63,63,63,63
,63,63,63
440 '***************************
450 'USED ONLY FOR SIGNON
460 FOR N=1TO150:READZ(N):NEXTN
470 N=N-1
480 FORI=1TON:P=Z(I):GOSUB600
490 NEXTI
500 '***************************
510 'MAIN LOOP AND ROUTINE
520 'SILENCE TALKER,GET NEW OR R
EPEAT OLD PHONEME STRING,
530 'THEN OUTPUT PHONEME CODES T
O SYNTHESIZER.
540 P=63:GOSUB600
550 GOSUB 660
```

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```
560 FORI=1TON:P=Z(I):GOSUB600
570 NEXTI:GOTO540
580 '*****************************
590 'TALK OUTPUT ROUTINE
600 POKEA,P:'PLACE 6-BIT PHONEME
 CODE AND INFLECTION ON PORT A
610 POKEA+1,52:'STB HIGH
620 POKEA+1,60:'STB LOW
630 V=PEEK(A):'DUMMY READ TO RES
ET CA1
640 IF (PEEK(A+1)AND128)THENRETU
RNELSE640'RETURN WHEN A/R GOES H
IGH
650 '*****************************
660 'LOAD PHONEME STRING
670 PRINT:PRINT"PRESS @ KEY TO P
LAY OLD STRING"
680 PRINT"OR INPUT NEW STRING XX
,XX, ETC."
690 AN$=""
700 A$=INKEY$:IFA$=""THEN700
710 PRINTA$;
720 AN$=AN$+A$
730 IFA$="@"THENRETURN
740 IFA$=CHR$(13)THEN750ELSE700
750 'DECODE STRING
760 ST=1:I=1:P$="":A$=""
770 'P$=NEXT PHONEME WHEN DONE A
ND IS MADE UP USING A$
780 'AN$=ENTIRE STATEMENT INCLUD
ING DELIMITERS (SPACE OR COMMAS)
790 P$=P$+A$
800 A$=MID$(AN$,ST,1)
810 'ST IS COUNTER USED TO STEP
THROUGH AN$
820 ST=ST+1
830 IF A$=CHR$(44)ORA$=CHR$(32)O
RA$=CHR$(13)THENGOSUB890ELSE790
840 IF A$=CHR$(13)THEN870
850 A$=""
860 GOTO 790
870 N=I-1:RETURN
880 '*****************************
890 'PHONEME CODES
900 IFP$="EH3"THENP=0
910 IFP$="EH2"THENP=1
920 IFP$="EH1"THENP=2
930 IFP$="PA0"THENP=3
940 IFP$="DT"THENP=4
950 IFP$="A2"THENP=5
960 IFP$="A1"THENP=6
970 IFP$="ZH"THENP=7
980 IFP$="AH2"THENP=8
990 IFP$="I3"THENP=9
1000 IFP$="I2"THENP=10
1010 IFP$="I1"THENP=11
1020 IFP$="M"THENP=12
1030 IFP$="N"THENP=13
1040 IFP$="B"THENP=14
1050 IFP$="V"THENP=15
1060 IFP$="CH"THENP=16
1070 IFP$="SH"THENP=17
1080 IFP$="Z"THENP=18
1090 IFP$="AW1"THENP=19
1100 IFP$="NG"THENP=20
1110 IFP$="AH1"THENP=21
1120 IFP$="OO1"THENP=22
1130 IFP$="OO"THENP=23
1140 IFP$="L"THENP=24
1150 IFP$="K"THENP=25
1160 IFP$="J"THENP=26
1170 IFP$="H"THENP=27
1180 IFP$="G"THENP=28
1190 IFP$="F"THENP=29
1200 IFP$="D"THENP=30
1210 IFP$="S"THENP=31
1220 IFP$="A"THENP=32
1230 IFP$="AY"THENP=33
1240 IFP$="Y1"THENP=34
1250 IFP$="UH3"THENP=35
1260 IFP$="AH"THENP=36
1270 IFP$="P"THENP=37
1280 IFP$="O"THENP=38
1290 IFP$="I"THENP=39
1300 IFP$="U"THENP=40
1310 IFP$="Y"THENP=41
1320 IFP$="T"THENP=42
1330 IFP$="R"THENP=43
1340 IFP$="E"THENP=44
1350 IFP$="W"THENP=45
1360 IFP$="AE"THENP=46
1370 IFP$="AE1"THENP=47
1380 IFP$="AW2"THENP=48
1390 IFP$="UH2"THENP=49
1400 IFP$="UH1"THENP=50
1410 IFP$="UH"THENP=51
1420 IFP$="O2"THENP=52
1430 IFP$="O1"THENP=53
1440 IFP$="IU"THENP=54
1450 IFP$="U1"THENP=55
1460 IFP$="THV"THENP=56
1470 IFP$="TH"THENP=57
1480 IFP$="ER"THENP=58
1490 IFP$="EH"THENP=59
1500 IFP$="E1"THENP=60
1510 IFP$="AW"THENP=61
1520 IFP$="PA1"THENP=62
1530 IFP$="STOP"THENP=63
1540 Z(I)=P+IN
1550 '*****************************
1560 'INFLECTION BITS ARE ADDED
TO PHONEME CODES
1570 IFP$="IN0"THENIN=0
1580 IFP$="IN1"THENIN=64
1590 IFP$="IN2"THENIN=128
1600 IFP$="IN3"THENIN=192
1610 I=I+1
1620 P$=""
1630 RETURN
```

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Software Review

Three Handy Utilities For 64K Disk Systems

A close inspection of the Spectrum Projects ad in last month's issue will reveal an offering called *64K Disk Utility Package* by Larry Banks Software. This package actually consists of three separate utility programs for a 64K Disk based CoCo. With the price of 64K chips going down to less than $50 a set, why not jump on the bandwagon? This utility package will give you an idea of the capabilities of a 64K machine. The three programs are named *40K*, *Software Print Spooler*, and *ROMcrack*.

The first program of the set is *40K*, a utility that moves the Extended BASIC ROM from $8000 to $D800. After a *LOADM*"40K":*EXEC*, a *PRINT MEM* statement will display 31015, an extra 8K of memory for your use. The manual states that $0000 to $9FFF is available for programs but this is not exactly true as certain low memory still contains that necessary stuff such as the screen display, buffers, etc. One interesting point noted is that after a *PCLEAR* statement you get a minus amount of available RAM. Numbers above 32767 are treated as negative by this command. I guess no one thought there would be more than 32K available in a CoCo. This particular program does not require a disk and, in fact, is available on cassette tape. The program performs as advertised and was tested with several of the longest programs I could find. None came close to invoking the dreaded OM error message. Caution is given regarding the use of the RESET button as this will wipe out any program currently in memory.

Software Print Spooler is loaded from disk by a *RUN* "SPOOL64" command and automatically executes and returns to BASIC. I was impressed. One of the programs I frequently use to answer the question of "What can this thing do?" is a biorhythm plotter. It is a unique program in that it calculates the values of screen output and formats a *PRINT* statement before each line is output to the printer. Due to the calculations required, a small wait is expected between lines as they print. After running this program with SPOOL64 you can appreciate the value of a "spooler." After answering all of the required information the program requires to execute, an OK prompt is on your screen while the printer is still working on the chart. Other calculations can be initiated and sent to the printer. This is only one example of the value of a buffered printer but I will leave it to you to determine the need. It sure is nice to put the extra memory gained in a 64K system to a useful purpose. One drawback of this program was the inability to function with a non-standard printer. Printer driver routines are no longer effective. Also, the printer must be operated at a baud rate of 1200 or higher.

The last program of the group will probably have the broadest appeal. *ROMcrack* is a utility allowing you to put ROMPack cartridges on disk for instant access. The procedure is not very complicated. First, the ROMPack is saved to tape by placing a piece of tape on Pin 7 and performing a *CSAVE*"ROM",&HC000,&HE000,&H000. Rewind the cassette, *LOAD*"ROMCRACK", *RUN* and magically your favorite game, etc, is on disk. You can now run your favorite games from disk by a *LOADM*"filename":*EXEC* command. Constant unplugging of the disk controller is avoided. I am not going to give away the secret of how this is accomplished, but I will guarantee that it works and once you see the program listing you will probably say "Why didn't I think of that!" The program was tested with no fewer than six ROMPacks and performed flawlessly.

I would recommend the 64K Disk Utility Package as an excellent addition to your software library. The documentation is average, but enough information is given to explain the program operation. Even though it is not part of this review I don't think you can beat the price of $49.95 for a set of 64K RAM chips from Spectrum Projects. I hope you can see some of the advantages of a 64K system.

(Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421, disk, $21.95)

—Dan Downard

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In addition, copies of the cover *only* of the July, 1982, Anniversary Issue are available separately for $1 each, plus 50 cents shipping and handling. These are suitable for framing.

GREETINGS from
UNCLE BERT

Dear Kids,

Well, I have my Color Computer fixed up in my den, right beneath the deer's foot hatrack, and right beside the old couch. I shouldn't be telling you this but that couch right now serves as a bed for me, because Aunt Bertha is still a little touchy about the pig incident which I'm sure I told you about, but in case I didn't, I promise I will, real soon.

In the meantime, though, I want to tell you about this new Color LOGO for the Color Computer. Color LOGO comes both in a cartridge form for a 16K machine, and disk form for the 32K machine. If you want to save any of your work, you'll need a cassette recorder for the cartridge system; but with the disk system, you can save everything right on the disk. I happen to have the cartridge form, but everybody tells me that the disk form works very much the same.

Now I guess everybody has heard about this programming language called LOGO, that was created at an eastern college by Seymour Papert and others (including Wallace Feurzeig, Harold Abelson, and Andrea DiSessa).

There are all kinds of things that people say about LOGO. They say that Mr. Papert and his friends designed LOGO, for instance, so that young children could learn how to program a computer without having to *study* at it. What I mean is that the LOGO language is supposed to be the kind of thing where you just play around with it, maybe work a little, and gradually you begin to discover things about how it works. They say it's a learners' language, or should I say—how is it put?—a "child-oriented, discovery-oriented" programming language. In his book, *Mindstorms,* Seymour Papert talks a lot about LOGO and about other things, and I guess one of his ideas is that LOGO can take very high mathematical ideas and concepts, and bring them down to earth—make them "concrete" is the word he uses. I don't know about concrete, but we shall see about that, because I'm going to be your living guinea pig for the next several months. It's a good thing that LOGO is a learners' language, because I am really a learner and I'm just beginning. So all of you who want to learn right along with me can continue reading, but all of you who already know something about Color LOGO should stop reading right now and come back in three months. Including me.

But first, let me say another thing. The original LOGO was developed starting about 1968 on a big computer system. As I just mentioned, Mr. Papert and others are trying to develop a computer system that would make mathematical ideas "concrete" (ferroconcrete would be longer lasting).

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One thing they did was hook up a computer to a little robot that looked and moved kind of like a turtle—they called the robot a "turtle." Now, the point is that LOGO can be used to draw pictures with a turtle, but it also is meant to do a lot more.

According to David Thornburg (in the March, 1983 issue of *Compute*), a lot of people think that LOGO is nothing but turtle drawings (graphics), and that turtle drawing is LOGO. But they're wrong. LOGO is more than turtle graphics. Thornburg says: "Atari PILOT has turtle graphics, but it's not LOGO." He also says that Color LOGO, although it has "superb turtle graphics" is also not really LOGO. He goes on to say that the "Radio Shack Color Computer supports much of what we expect from LOGO—extensibility, local variables, recursion, and turtle graphics. However, the only variables that can be used with this language are numbers. There is none of the list processing capability that gives LOGO its tremendous power as a symbol manipulation language."

Well, I don't know about all this, and I wonder if anyone out there has any good opinions. As I understand it, Color LOGO doesn't have something called "list processing," which is supposed to be a very important part of "the real LOGO." People such as David Thornburg and others would like to call this new product "turtle graphics." Whatever the case, Color LOGO works on an inexpensive machine, and the disk itself is not very expensive (the cartridge is even less expensive). The turtle graphics it creates are supposed to be good. Thus, at the very least it's a good way to get started with turtle graphics.

Controversy! I'm not an expert, so I can't really say much more, but I know there are experts out there who might be willing to explain all this in *greater detail* in a letter. So send me a letter, you experts, and I'll see that your expertise gets in print.

Well, I have my Color Computer here. It's turned on, and I'm in the *BREAK* corridor. Let's just try out a little turtle graphics, and see what happens. So, press R and enter the *RUN* room.

Now, that tiny outhouse-shaped object in the center of the screen is really a turtle that can draw. Type in FORWARD 10, for instance, press *ENTER*, and the turtle will move straight up and deposit a short line where it's moved. Actually, you can shorten that command to FD 10.

Try other numbers after FD. Now try to move the turtle right back to where it started: type in BACK 10, followed by an *ENTER*. Then type in BACK with whatever other numbers are necessary to get the turtle right back to where it started. (You can shorten BACK to BK.)

Is the turtle back in the center of the screen? Good. Now, type in RIGHT 45, and press *ENTER*. What happens? Now type in RIGHT 45, and *ENTER*.

Now type in LEFT 90, and *ENTER*. You should be back to the original position. (You can shorten RIGHT to RT, and LEFT to LT.)

Now enter the following sequence:

```
LT 90
LT 90
LT 90
LT 90
```

Now enter this:

```
FD 30
RT 90
FD 30
RT 90
FD 30
FT 90
FD 30
```

Well, that's semi-interesting. You should have a square on your screen. Now, how about trying to draw a pentagon, a hexagon, an octagon, a decagon (ten-agon)? Try to draw a circle. Try a triangle. All of these shapes and figures will be useful later on. Send me a letter: let me know how you did it. Is there more than one way to do any of these? How can I think about drawing these shapes? How did you figure them out?

I see I'm running out of space, so we'll have to continue next month. I'll try my darndest then to fill you in on the pig incident and other important things. Be good, kids and tell your dad to get a LOGO cartridge for your Color Computer. Greetings to all. I remain,

Uncle Bert

P.S. You can send your cards and letters to me in care of my good friend Dale Peterson. Just address them like this:

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CORRECTIONS

All of *the Rainbow's* program listings are printed on an Epson MX-80F/T dot matrix printer formatted for 32 character line width, double-strike and emphasis. We consider it a dependable, workhorse of a machine and have encountered only one occasional problem—about once a month it seems to miss a carriage return (or *ENTER*) command when *LLISTing* a program. Such is the case on page 40 of the June 1983 *Rainbow*. Lines 28 and 29 of *Rainbow Roach* are tacked on the end of line 27 rather than printed out as separate lines even though the original program and *Rainbow on Tape* both list 28 and 29 as separate lines. We regret any inconvenience this may have caused.

An error in the P 'n' P Real Time Clock program as published in the April issue of *Rainbow* causes the day of the week to be displayed incorrectly at times. The correction is:

1. In line 210 change the + to —. The line now reads:

```
210 DAY=(INSTR(1,"SUMOTUWETHFRSA",LEFT$
(A$,2))-1)/2
```

2. In line 340 change 39 to 43. The line now reads:

```
340 DATA 230,88,88,48,141,0,43,58,198,4
```

In "PATCHing The Patch: *EDTASM+* To Disk Revisited" (April 1983), Roger Schrag's street number was listed incorrectly. His correct address is: 2054 Manning Avenue, Los Angeles, Cal., 90025.

In Bob Rosen's short article, "This Will Program Your Keys On *Professional* Keyboard" (June 1983), data items are incomplete in lines 2 and 10. Correctly, these lines should read:

```
2 CLEAR200,A—226:A=PEEK(116)*256+PEEK(117):
FOR X=A—226 TO A: READ A$: POKE X, VAL
("&H"+A$):NEXT:EXEC A—226:NEW
10 DATA BE, 01, 6B, 0F, FD, 9F, F8, BE, 01, 68, BF, 7C,
E1, 31, 8D, 00, 15, 10, BF, 01, 6B, 86, 7E, B7, 01, 6A, B7, 01,
67, 31, 8D, 00, B1, 10, BF, 01, 68, 39, 32, 62, AD, 9F, 00, F8,
0F, 70, 0D, 6F, 27, 03, 7E, A1, 7F, BD, A1, B1, 81, BD, 27,
F9, 81, 04, 27, F5, 81, 67, 27, 45, 81, 13, 10, 27, 00, 4E, 34, 02,
B6, 01, 56, 85
```

Also, while the program, as written, works with disk, cassette users will want to change line 30 to read:

```
30 DATA 2F, 8E, 04, 00, C6, 20, A6, 80, 81, 60, 26, 04, 86,
20, 20, 0E, 81, 20, 24, 04, 8B, 60, 20, 06, 81, 60, 25, 02, 88, 40,
84, 7F, BD, A2, BF, 5A, 26, E0, 86, 0D, BD, A2, BF, 8C, 06,
00, 26, D4, 35, B6, 0D, 6F, 26, 0A, 0D, FD, 27, 06, 81, 41, 25,
02, 88, 20, 7E, 82, 73
```

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Compiled and Edited
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RULES: All programs must be original works, no "conversions." Entries must be postmarked by July 30 and become the property of Falsoft, Inc. publisher of *the Rainbow*. Decision of the judges is final. Duplicate prizes will be awarded in the case of ties. Winning programs to be featured in a special *Rainbow* Simulation issue. Mark entries "Simulation Contest Editor" and send to *the Rainbow*, P.O. Box 209, Prospect, KY 40059.

Book Review

Small Sourcebook Should Be Big Hit For Programmers

Have you ever bought a TRS-80 sourcebook and found you had to sort through hundreds of listings just to find one that worked on your computer? I know I have, and it always frustrated me severely. That is, before the *TRS-80 Programmer's Sourcebook* became available.

The *TRS-80 Programmer's Sourcebook* is a publication containing listings of programs of all TRS-80 computers. This 70-plus-page first edition also contains a listing of reference publications, periodicals, books, advertisements, and a listing of clubs which welcome TRS-80 users. The book comes in an 8½" x 11" paperback format.

The thing which makes the *TRS-80 Programmer's Sourcebook* so easy to use is the way the listings are arranged. Unlike Radio Shack's sourcebook, the *TRS-80 Programmer's Sourcebook* organizes the listings by computer model. The *TRS-80 Programmer's Sourcebook* also lists not only application software, but system software as well. The application software is further divided into the following categories: Business/Accounting, Business/Inventory Control, Education-Classroom, Education-Home, Games, Home/Personal Use, Specific Industry/Profession, and Statistics/Math. The system software, program listings Radio Shack seems to refuse to print, are divided into the following categories: Data Management Services, Debugging Tools, Editors, I/O Services, Languages, Operating Systems, Routines, and Utilities. The author stated a new section, Assemblers/Dissassemblers, will be added in future issues.

This new publication will be offered bi-yearly in January and July. The first issue, published in January 1983, is only 80 pages long. However, the author is soliciting people to send in program publication forms of their programs. The author is also looking for companies to advertise in his publication. If people and companies contribute to the book, *TRS-80 Programmer's Sourcebook* will become a big hit. I found this issue to be slightly small, but I'm sure future issues will become bigger and even better.

(Ocean, Inc., P.O. Box 2331, Springfield, VA 22152, $4.95)

—Dave Mercer

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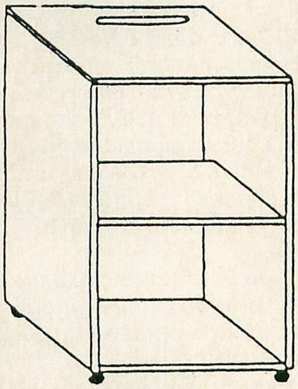

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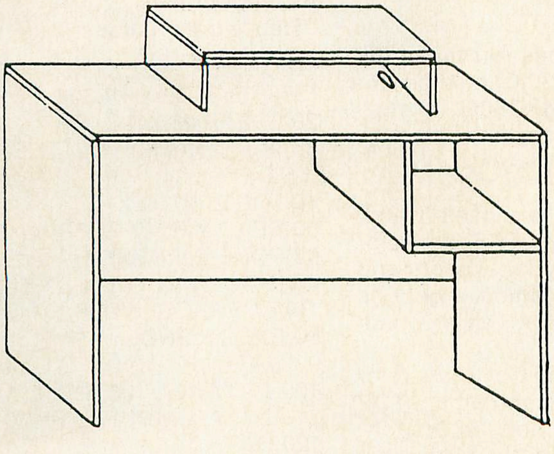

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RAINBOW Info

How To Read Rainbow

Please note that all the BASIC program listings you will find in *the Rainbow* are formatted for a 32-character screen — so they will show up just as they do on your CoCo screen. One easy way to check on the accuracy of your typing is to compare what character "goes under" what. If the characters match — and your line endings come out the same — you have a pretty good way of knowing that your typing is accurate.

We also have "key boxes" to show you the *minimum* system a program needs. But, *do* read the text before you start typing.

Finally, the little cassette symbol on listings indicates that program is available through our *Rainbow On Tape* service. An order form for this service is on the insert card bound in the magazine.

RAINBOW
CERTIFICATION
SEAL

The Rainbow Seal

The Rainbow Certification Seal is our way of helping you, the consumer. The purpose of the Seal is to certify to you that any product which carries the Seal has been physically seen by us and that it does, indeed, exist.

Manufacturers of products — hardware, software and firmware — are encouraged by us to submit their products to *the Rainbow* for certification. We ascertain that their products are, in actuality, what they purport to be and, upon such determination, award a Seal. This lets you know that we have seen the product and that it does, indeed, exist.

The Seal, however, is not a "guarantee of satisfaction." The certification process is different from the review process. You are encouraged to read our reviews to determine whether the product is right for your needs.

There is absolutely no relationship between advertising in *the Rainbow* and the certification process. Certification is open and available to any product pertaining to CoCo. A Seal will be awarded to *any* commercial product, regardless of whether the firm advertises or not.

We will appreciate knowing of instances of violation of Seal use.

Using Machine Language

Machine Language programs are one of the features of *the Rainbow*. There are a number of ways to "get" these programs into memory so that you can operate them.

The easiest way is by using an Editor-Assembler, a program you can purchase from a number of sources.

An editor-assembler allows you to enter mnemonics into your CoCo and then have the editor-assembler assemble them into specific instructions that are understood by the 6809 chip that controls your computer.

When you use an editor-assembler, all you have to do, essentially, is copy the relevant instructions from *the Rainbow's* listing into CoCo.

Another method of getting an assembly language listing into CoCo is called "hand assembly." As the name implies, you do the assembly by hand. This can *sometimes* cause problems when you have to set up an ORIGIN statement or an EQUATE. In short, you have to know something about assembly to hand assemble some programs.

Use the following program if you wish to hand assemble machine language listings:

```
10 CLEAR200,&H3F00:I=&H3F80
20 PRINT "ADDRESS:";HEX$(I);
30 INPUT "BYTE";B$
40 POKE I,VAL("&H"+B$)
50 I=I+1:GOTO 20
```

This program assumes you have a 16K CoCo. If you have 32K, change the &H3F00 in Line 10 to &H7F00.

What's A CoCo

CoCo is an affectionate name which was first given to the TRS-80 Color Computer by its many fans, users and owners. As such, it is almost a generic term for three computers, all of which are very much alike.

When we use the term CoCo, we refer to the TRS-80 Color Computer, the TDP System-100 Computer and the Dragon-32 Computer. It is easier than using the three "given" names throughout *the Rainbow*.

In most cases, when a specific computer is mentioned, the application is for that specific computer. However, since the TDP System-100 and TRS-80 Color are, for all purposes, the same computer in a different case, these terms are almost always interchangable.

The Rainbow Check

The small boxes which you see with programs in *the Rainbow* are our *RAINBOW CHECK* program, which is designed to help you type in programs accurately.

The check program itself is a machine language program which will count the number of characters you type in. You can then compare the number the *RAINBOW CHECK* gives you to those printed in *the Rainbow*. On longer programs, some benchmark lines are given. When you reach the end of one of those lines with your typing, simply check to see if the numbers match.

To use the *RAINBOW CHECK*, type in *CLEAR 25, 16303* (or *CLEAR 25, 32687 for 32K) and CSAVE* the program that follows. Then type in the command *EXEC* and press *ENTER*.

Now, whenever you press the down arrow, CoCo will give you the hexadecimal number of bytes in memory. This is to check against the numbers printed in *the Rainbow*. If your number is different, check the listing carefully to be sure you typed in the proper BASIC program code.

Type in programs *exactly* as you see them printed in *the Rainbow*. All BASIC listings are printed out 32 characters wide, conforming exactly to the CoCo screen display. Because the *RAINBOW CHECK* counts spaces, too, you should follow the spacing just as it appears in the magazine.

Here's the program:

```
 10 CLS:IF  PEEK(116)=127  THEN
X=32688 ELSE X=16304
 20 CLEAR 25,X-1
 30 IF PEEK(116)=127 THEN X=32688
ELSE X=16304
 40 FOR Z=X TO X+77
 50 READ Y:W=W+Y:PRINT Z,Y;W
 60 POKE Z,Y:NEXT
 70 IF W=5718 THEN 80 ELSE PRINT
"DATA ERROR":STOP
 80 EXEC X:END
 90 DATA 182, 1, 106, 167, 141, 0, 68
 100 DATA 134, 126, 183, 1, 106, 190
 110 DATA 1, 107, 175, 141, 0, 57, 48
 120 DATA 141, 0, 4, 191, 1, 107, 57
 130 DATA 129, 10, 38, 44, 52, 22, 220
 140 DATA 27, 147, 25, 142, 4, 0, 141
 150 DATA 6, 31, 152, 141, 2, 32, 25
 160 DATA 52, 2, 68, 68, 68, 68
 170 DATA 141, 4, 53, 2, 132
 180 DATA 15, 129, 9, 46, 4, 139, 112
 190 DATA 32, 2, 139, 55, 167, 128, 57
200 52, 22, 126, 0, 0
```

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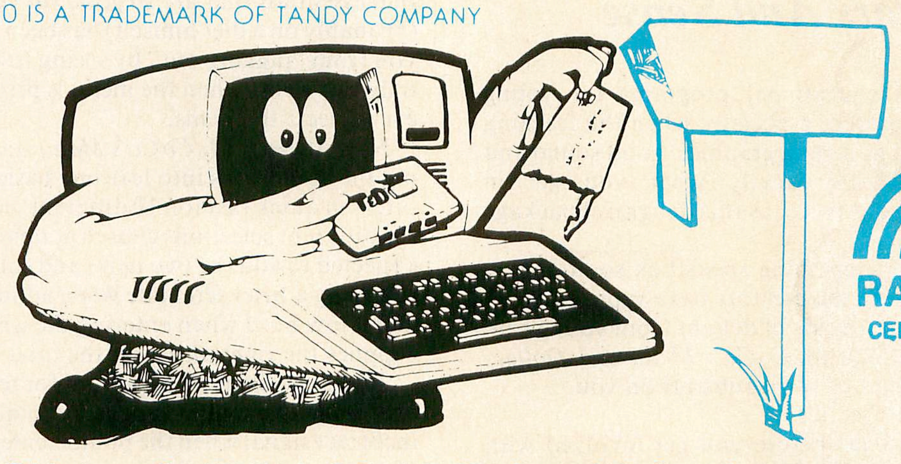

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A Break At *McCoCo's* & *Dollars And Sense*

Exceptionally good educational programs for young children are to be treasured, especially when the learning experience is enhanced by strong graphics, good sound and playtime qualities. That's exactly what you get in *Moneypak*—not once, but twice, as this delightful package contains two gems.

You know you have something special as soon as you open the package because the creators have supplied $6.71 in play money, bringing squeals of delight from young son. And you can't wait to load *McCoCo's Menu* and *Dollars and Sense,* as the contagious spirit rubs off on you.

First, it's a trip to McCoCo's. . .

Better grab a bite to eat before you get involved with *McCoCo's Menu* because, if my experience is any indicator, about halfway through you will experience a dryness of the mouth, severe hunger pains and a growling stomach. If you've ever had a "Big Mac Attack," you know the sensation and there's only one cure.

A golden arch, cleverly contained in the rainbow over the neat little restaurant, and the familiar tune of "You, You're The One. . ." welcome you to what is obviously a fast-food establishment. After introducing yourself via the keyboard to this 16K-ECB-required program you are referred to by your first name when you place a new order.

The menu consists of burgers, hot dogs (?), malteds, coffee, pie, French fries, shake, and salad—all of those vitamin-rich essentials that are so good for you. The game's creator (probably on a diet himself) has been wise enough to protect you from "pigging out" by seeing to it that you are allowed only two items when the menu is presented. Plus, *McCoCo* even selects the items.

Nevertheless, *McCoCo's Menu* is a great vehicle for enticing the youngsters into learning basic arithmetic. The game offers in quick fashion 10 different menus, with the prices of the different selections chosen at random. The "customer" is expected to add the two items and enter the correct amount, receiving a brief serenade when adding in the right amount and a low buzz when entering the wrong answer. *McCoCo* supplies the right answer if the total is incorrect.

The game also is a good tool for teaching youngsters the use of the decimal in monetary totals, responding with an incorrect signal when the point is entered in the wrong place.

Another benefit, I was surprised to learn, was that the game also is useful to youngsters who own hand-held calculators. In yesteryears that would have been a no-no, but according to one of my seven-year-old son's future teachers, he should have an opportunity to practice using them. Can you believe they're using them in the third grade? I guess it's not too surprising, because I've learned that CoCo is being

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used at the kindergarten level in some schools. Anyway, my young son will also practice his math on *McCoCo's Menu* using the old-fashioned method, with pencil in hand.

At any rate, 10 points are awarded for each correct answer (or vice-versa). Scoring nine correct answers out of 10 questions, for example, gives you a 90 percent score. If you grade yourself on the Bell curve, give yourself an "A". *McCoCo* offers encouragement along the way if you don't do so well ("Better luck next time" or "You need more practice"), and gives you praise if you do well ("Great game!").

After the colorful opening to the game, I was a bit disappointed when, finally getting all the answers right, I wasn't rewarded with the rest of the opening tune or something! After forgetting about the decimal point placement several times and committing several careless errors, I felt I had earned more than a written note.

For a children's learning game, a lot of extra work has obviously gone into the program. It's easy to *CLOAD* and fun to play, making the learning experience a pleasant one.

Dollars and Sense, the other program in the package, is probably just as good, although it lacks the logical appeal of the fast-food restaurant atmosphere.

There are three levels of skill, which makes it nice if you have children in different grades, and ensures a continued interest in the program if you have only one child. The first level is up to 50 cents, the second $1, the third $2.99.

Familiar objects—checkers, crayons, soda pop, toy car, a Basic Man comic book, pumpkin, toy plane, ice cream—that evoke happy memories keep the child wondering what's next. Some nice things happen to the objects, too. The soda pop, complete with straw, suddenly evaporates. The ice cream disappears, gulp by delicious gulp. A puppet changes its shape, etc. A great touch, actually, and almost as appealing to the kids as the Saturday morning cartoons.

The challenge for the youngster is to type the number of coins needed to make up the price of the object. The symbols are: "$" for dollar, "H" for half dollar, "Q" for quarter, "D" for dime, "N" for nickel, and "P" for penny. The child is required to type in the correct amount of money to make a purchase. The program is flexible in that there are several different combinations of coins that can be used, just as in real life.

If the puppet, for example, costs $1.25, the children can type in a dollar and a quarter, a dollar, two dimes and a nickel; even 125 pennies—the possibilities are as many as there are in real life.

After the child has entered what he or she thinks is the correct amount, the total is entered. If the amount is correct, the next item is presented. If wrong, a way is shown to get the right answer. There are 10 items in a series and, upon completion, the child receives a report card and, if he or she has done a good job, some congratulatory remarks.

Computer Island has done its homework and the results show in both ends of this program. An A+ is awarded to those folks for excellent work. We look forward to more such programs.

(Computer Island, 227 Hampton Green, Staten Island, NY 10312, $22.95 tape)

—Charles Springer

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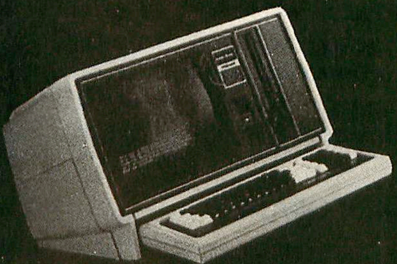

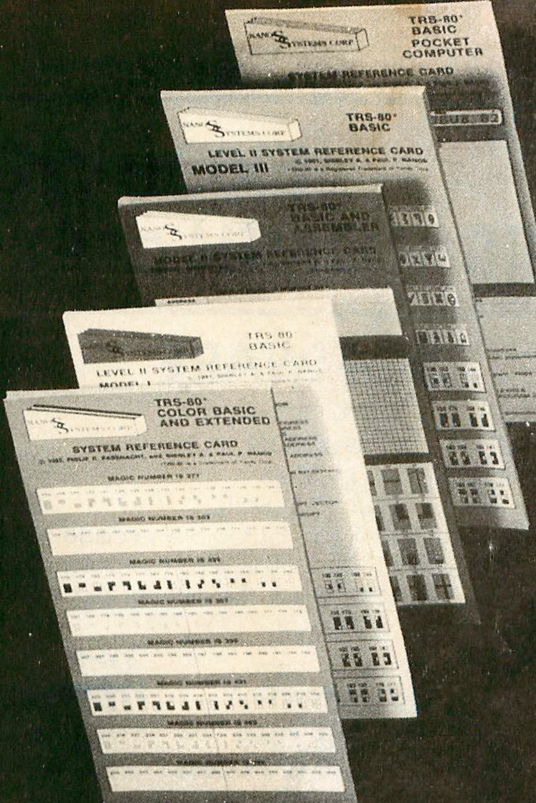
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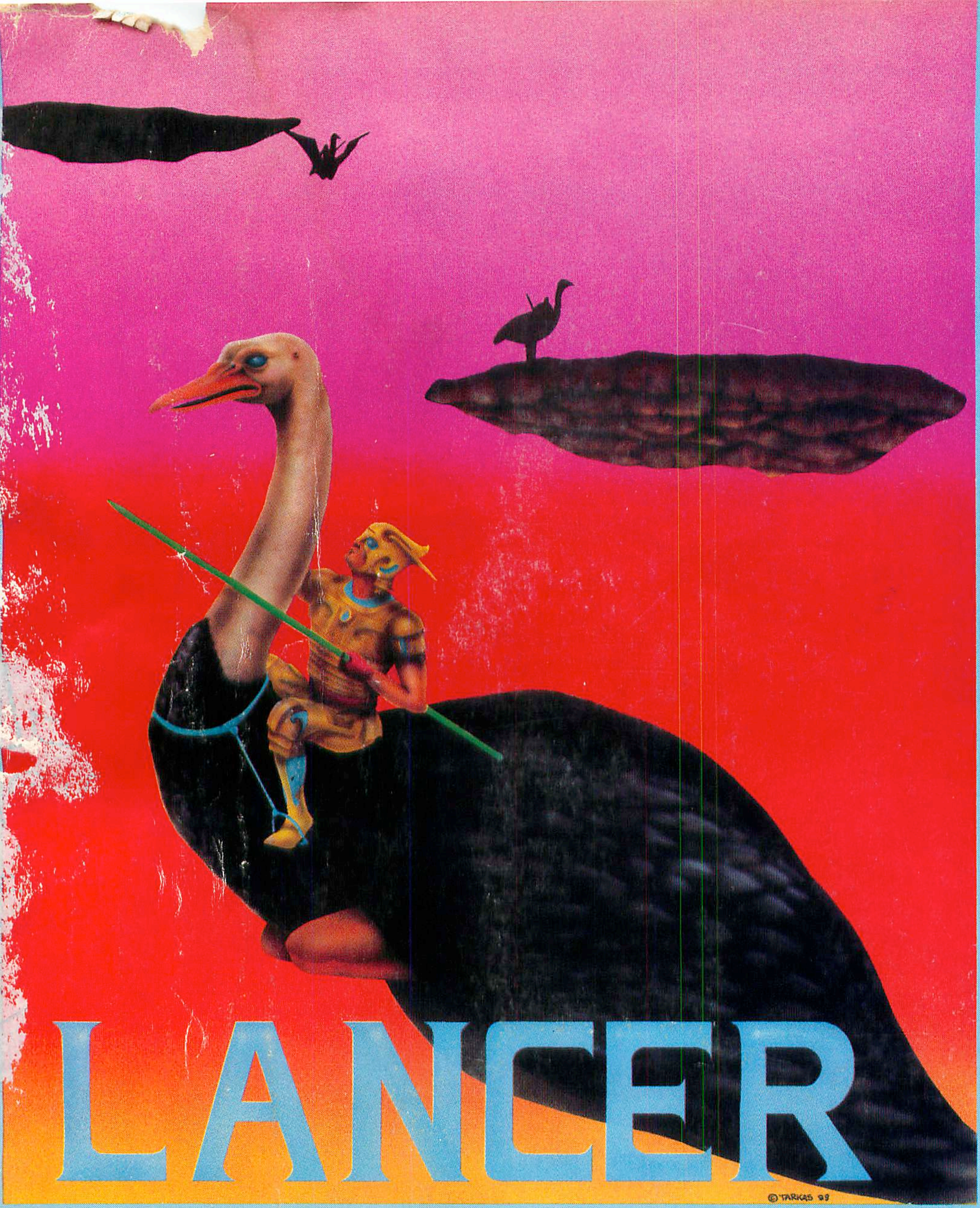

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